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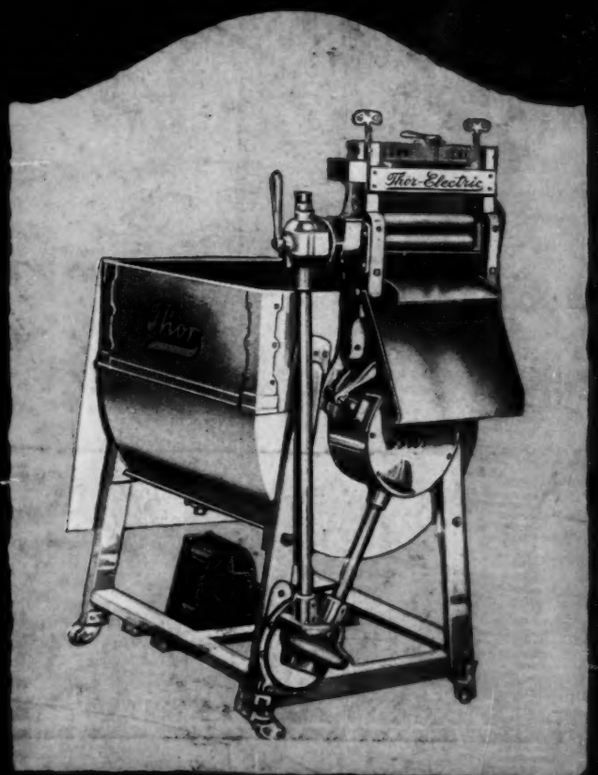

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Institute Decentralization

WESTERN members of the American Institute of Electrical Engineers are dubious about the sincerity of the Institute authorities in seeking to decentralize its work. This idea is fostered by the overwhelming number of Eastern men appointed to committee chairmanships. In the list recently published approximately 75 per cent of the chairmen live no farther west than Philadelphia, and about 10 per cent are located west of Cleveland. There is no disposition to belittle the ability or professional standing of those appointed. Rather, their high standing is freely admitted, but it is felt that in the main the men represent Eastern thought and practice. The West was gratified when some Western members were nominated and elected to the board of directors and when Western ideas were incorporated in some of the recommendations of the committee on development; but it was expected that the work would be continued and reflected in the appointment of some Westerners to committee chairmanships as well. That this has not been done comes as a disappointment to those who were beginning to take a livelier interest in Institute affairs and who were inclined to believe that Eastern domination would in future be less apparent. However, it is not too late to have an ample number of Western engineers appointed on committees for which they are best fitted, and we hope this will be done.

Great interest is being aroused by the plans for electric shows this year. They present fine opportunities to tell the old story in a new way to a public which needs labor-saving devices and appreciates their value.

Mr. Britton's Plea from the West

JOHN A. BRITTON'S letter to the public policy committee of the National Electric Light Association is straightforward and to the point. He pleads for closer comradeship between the East and the West in public utility matters and calls to remembrance sins of omission and commission. It is only too true that both the National Electric Light Association and the American Institute of Electrical Engineers have manifested only a passive interest in water-power legislation, and it were well if both organizations bestirred themselves on so vital and national a question as the conservation of the water-power resources of the country. Mr. Britton does well to bring the matter forward at this time, because the work of water-power development West or East will fall to the lot of the electrical engineering profession, and the nation must have sufficient power for its industries and citizens. An injustice has also been done to Far Western utilities in the adoption of overhead-line construction standards particularly suited to Eastern conditions. Past-president E. R. Davis and the Pennsylvania Electric Association have both sensed the injustice to Western utilities and fought the original overhead-line specifications so that they no longer carry official sanction and weight, but it is hard to undo something once established and published. Therefore Eastern overhead-line specifications still plague utilities in many other sections of the country. However, the N. E. L. A. has not been entirely negligent or unmindful of its obligations to its member utilities. During the war no other association in the country did such true and laudable service. Its committee on gas and electric service was especially active and responsive to the calls both of the government and the utilities themselves and earned the commendation of both. Mr. Britton is not unmindful of that work but seeks to have the other important committees of the N. E. L. A. emulate it so that truly national service shall be rendered by all and the year be exceedingly bright for public utilities. Certainly that is a consummation devoutly to be wished.

As an industry the central-station properties have tried to recognize and meet in anticipation great movements which affected their operations. They have been leaders, not followers. This period of momentous world changes calls for constant, keen and wise foresight.

Development of Arc Radio Transmitters

THE strides which radio-engineering has made during the last few years were indicated in the article by A. L. Anderson and H. F. Elliott last week. It is only very recently that there was no radio-engineering and all that was known scientifically about the subject was found in the textbooks on physics and natural philosophy. It is no disparagement of physics to say that this great application of physics, radio-communication, has flitted from the parent tree and built a nest for itself in the engineering world.

It reads very easily to the casual peruser that radio arc transmitters of nine standard sizes and powers, between 5 kw. and 1000 kw., are manufactured for use in this country and abroad; but engineers and manufacturers will recognize what such a result means in designing, inventing, researching, building, standardizing and throwing on the scrap pile.

Probably not even its best friend would say that the original arc transmitter, as put into service, was a graceful device or one of pleasure to look upon. The devices illustrated in the article show, however, that this early defect has been largely overcome.

The article contains much interesting and useful information that will appeal to electrical workers in all

branches, as well as to radio-communication men. It is hoped that the writers will shortly pursue the subject by giving representative numerical data of tests and efficiencies, as obtained from some of these arc-transmitter plants. It would be interesting to know, for example, how far harmonics and stray frequencies have been eliminated from the antenna branch. It has been supposed that the arc generator hatched all sorts of frequencies in addition to the particular frequency utilized for transmission. If this is correct, no doubt the arc engineers have taken steps to eliminate the offending stray waves.

A very noticeable feature of the connection diagrams is their simplicity. It is hard to imagine how the connection between the antenna and the generator might be further simplified.

Manufacturers in some lines are reducing quality, careless of their reputation. This is not the policy of electrical manufacturers of this country, who have sought to preserve their world-wide fame for high-grade apparatus and supplies.

Magnetic Tests for Non-Electrical Steel

IT IS well known that physical irregularities in steel are usually accompanied by a corresponding variation in the magnetic permeability. This fact has been suggested more than once as a means for testing rails and other steel products subject to heavy mechanical stresses. A device was developed at the Bureau of Standards some years ago for testing steel rails by magnetic induction. To use it the rail was properly magnetized and a small carriage driven along it, with a coil in which a voltage was induced by the motion. Any irregularity in the distribution of the magnetic flux was shown in the variation of the induced emf. Such a device is somewhat laborious and delicate and is hardly suited to tests in a steel mill. During the years of the war quantity was entirely subordinate to quality, and the latter undoubtedly suffered. Now it is time not only to return to the pre-war standards but to raise those standards, or at least to devise means for insuring the uniformity of products. A healthy progress in railroading will require heavier rolling stock and higher speeds. Rail quality and uniformity must keep pace with this progress. Mechanical tests of rails are out of the question, except as to samples picked out at random. But it is a rail with a flaw that was not picked out for test that causes a disastrous wreck.

Magnetic testing seems to be the only feasible method at the present time unless the X-ray technic is developed so that an inspector can view each rail through a screen or have a photograph taken and thus detect spots presumably indicative of faults. The ultimate problem is not to test one rail or beam out of a hundred or out of a dozen, but to test each individual rail for the sake of the human life involved. It is different from a case of door hinges, for which it is sufficient for the maker to guarantee "to replace any hinge found defective." A replaced defective rail will not replace the lost human lives. Here is a problem well worthy of an earnest effort not only by an individual investigator but by a government agency or an endowed institution. The development of a device that would indicate an irregularity in structure is but one part of the problem. Another part is to connect these magnetic irregularities with real mechanical weaknesses and to distinguish these from harmless non-homogeneities in structure.

Unbalanced Three-Phase Loads

THE three-phase system is ideally a balanced system, and, like most other ideal systems, is found in its ideal state only in museums. In practice three-phase systems are never found to be strictly balanced. Any practical system that is pronounced to be balanced is a system in which the precision of the measurements is confessedly limited. Nevertheless, for many practical purposes a large number of practical three-phase systems are sufficiently balanced to be treated as though they were strictly balanced without inconvenience or qualms of conscience. Occasionally, however, a three-phase system presents itself that not even the most charitable consideration can accept as balanced, and then the unbalance must be faced and dealt with numerically. The same treatment must also be resorted to in cases of nearly balanced systems when the smile of charity is replaced by the frown of higher criticism; so that the three-phase engineer must be prepared to deal with either balanced or unbalanced systems as they present themselves in fact as well as in conscious seeming.

An interesting graphical method for assigning the position of the virtual neutral point in an unbalanced three-phase, star-loaded system is given this week by Prof. L. A. Doggett, the three star branches having the same power factor. The method employs an abaque of defined construction, which is easily kept on file, for a system of balanced voltages: *i. e.*, a system whose voltage diagram is an equilateral triangle. In other cases, with unbalanced voltages, the abaque can be applied on the correctly drawn unequilateral triangle, from the table of numerical data supplied with the article.

Professor Doggett's abaque for unbalanced star loads is well worth remembering and is a useful graphical contrivance. It is, however, as the article states, limited in application to the case of the same power factor in all three star branches.

A method for determining the position of the virtual neutral point of an unbalanced three-phase, star-loaded system was, however, published in the ELECTRICAL WORLD some years ago. This method is equivalent to the new Doggett method with equal branch power factors and applies also to unequal branch power factors. It regards the voltage triangle of the system considered as a plane triangle of mechanical strength but with negligible mass. At the vertices of the triangle masses are supposed to be attached respectively proportional to the three star-branch admittances. The center of gravity, or mass center, of these three mho loads will occupy a point in the plane which is the virtual neutral of the unbalanced three-phase, star-load system.

If the three star loads are different loads of pure resistance, the three masses will be pure conductance masses and will be real quantities. The center of gravity of any pair, such as A and C, will lie on the side AC, at the point fixed by the Doggett abaque. Calling this point X and locating the sum of A and C there, the center of gravity of the whole system will lie on the line connecting B and X and will coincide with the intersection of the two lines on the Doggett abaque.

If, however, the three star loads are not only different but have different power factors, their admittances will be complex quantities and their representative masses, attached to the three vertices, will be complex masses. Complex masses do not seem to occur in the gravitational world, but may be handled arithmetically as though they existed, using the center-of-gravity for-

mulas of real masses. The center of gravity of two such complex masses, such as A and C, will then lie, in general, off, or one side of, the line AC connecting them. Calling this point X, as before, and repeating the operation for the sum of A and C at X, and the remaining mass at B, a new center of gravity is found which may easily lie outside of the triangle. In extreme cases of unbalance, such as may be produced in the laboratory, the virtual neutral point and mass center of the system will be in the plane of the triangle but many sides length outside of it. This corresponds to the well-known case of unbalanced star-load resonance.

Increased production and economy is the slogan of the times. This is a program which well describes the historic general aim of central-station management. Keep up the standard inside the company so that consumers shall realize the benefits in service.

Lighting a Subway

IN A DISCUSSION elsewhere in this issue on the lighting of the Cleveland subway connected with the Cuyahoga River bridge, Ward Harrison and E. A. Anderson give extremely valuable suggestions regarding a difficult lighting problem. The engineers in charge, through the assistance of the engineers of the National Lamp Works, were able to profit by some important experience and investigation of the latter along just this line in connection with the entrance to their own works. Lighting a subway station and the passages connected with it is no easy task. A fair intensity is necessary, with strong diffusion to cut down the shadows and give the space a cheerful appearance, and also a good deal of light on vertical surfaces to facilitate recognition. In addition, subways and subway stations are usually quite low, so that the light sources must be exceptionally free from glare and either wholly or partly indirect, or of very low brilliancy. Further, all bright lights should be kept out of the view of motormen to avoid erroneous estimates of distance.

In the case before us the lighting of the principal station was accomplished by lighting fixtures flush with the surface, a device made possible by the early stage of construction at which the lighting scheme was worked out. Each fixture carries two 75-watt gas-filled lamps, one burning tip down and the other tip up, backed by porcelain, enameled reflectors and concealed by an opal-glass plaque set in front, flush with the surface of the wall or column. The pairs of lamps are wired on two separate circuits, so that the lighting can be cut down while still retaining the same number of lighting fixtures in service. The cross-over tunnels are illuminated in precisely the same way. This is particularly advantageous since their white tile walls would produce glare from sources not skillfully diffused. The subway passenger station at the east end of the bridge was unluckily too far along when the lighting plans were made to use the same excellent fixtures, and a pendent unit was employed with opal-glass diffusing sides and bottom, fitted as in the former case with two lamps on separate circuits. In the car tunnel approaches tungsten lamps, with bowl reflectors cutting off all direct glare from the motormen, were mounted directly over the car tracks. The whole system of lighting circuits is divided so that two entirely independent sources of power are available for part of the lamps in each section. This important precaution was well taken, because since the system was started each source has been temporarily out of service. This installation emphasizes three important points in subway lighting, the abolition of glare by properly diffusing fixtures, the insurance of safety by duplicate and independent circuits, and, finally, the importance of planning the lighting of any important work far enough ahead of construction to allow working out the problems of illumination in a thoroughly efficient manner. When lighting is an afterthought it is difficult to obtain results at the same time efficient and economical, while if time is taken by the forelock in this work most admirable results can be easily attained.

A share in management as well as in profits is to-day recognized as expedient for the employee capable of realizing the meaning of responsibility. Time will tell how far it is safe to go in this direction in particular cases, but already a sort of leaven is at work in the industrial ferment, and a new confidence is becoming apparent between employers and employees where the mutuality of their interests is acknowledged.

Soot Deposit on Insulators

THE dust and smoke in a steel-mill district consists of particles of coal, graphite, iron ore, and of very fine particles of iron. Acid fumes help to make this mixture still more obnoxious to the operating electrical engineer. To put it more vividly, the mixture just described could hardly be surpassed in effectiveness if some one wanted a thin conducting layer on the insulator surface. This dust also interferes with the proper functioning of electrical apparatus in power stations and substations and with shop motors. However, in a building, vigilant wiping or blowing with compressed air solves the problem fairly well. The deposit becomes a real nuisance outdoors, on insulators on transmission and distributing lines. It makes it necessary to use types of insulators with a larger creepage surface, and even then they have to be wiped off, say every month, to avoid grounds and interruptions. In some localities this is true not only of 2200-volt lines and higher, but even of ordinary 220-volt direct-current distribution, where insulated conductors are used. With acid fumes this insulation lasts but a short time, and then one has to rely entirely on porcelain insulators for keeping the potential different from the ground.

This problem has two aspects, namely, prevention of deposits on insulators and a simpler method of cleaning them. Roughly speaking, the first one is for a physicist to tackle, the second one for a practical engineer. Electrical precipitation of dust and smoke has been successfully accomplished, and the physical problem here is of a somewhat similar nature. The ambient particles of dust must be electrified in some such fashion that they will settle elsewhere than on the insulator surface. The first step might be an experimental study of the actual motion of particles of graphite dust or flakes in the vicinity of an insulator carrying a charged conductor, with either direct-current or alternating-current voltage, from the lowest to the highest. After this has been accomplished some idea might be obtained as to how to prevent these small particles as much as possible from settling on insulators.

European Power Plant Practice—I

A Study of European Plants Indicates New Lines for Development in This Country and Also Shows Where American Engineers and Manufacturers Might Extend Operations—There Are Virtually No Outdoor Substations in Western Europe

BY STEPHEN Q. HAYES
Engineering Department Westinghouse Electric & Manufacturing Company

ON ACCOUNT of the relatively short distances over which electrical energy is transmitted in western Europe there are few high-voltage systems (100 kv. and above). In Italy and France, however, water power has been extensively developed. Some very important power projects have been started or are under consideration in France. In the Pyrenees, for instance, it is proposed to utilize 200,000 kva., whence energy will be transmitted at 120 kv. to industrial centers. A noteworthy installation is that at the Subiaco plant in Italy. No step-up transformers are required at this plant since the generators deliver energy at 30,000 volts for transmission to Rome.

In Great Britain plans are being developed to replace some 600 steam plants, averaging 5000 hp., by a few large modern stations. The possible saving in coal is estimated at about 70 per cent.

A large portion of the State Railways in the northern part of Italy has been electrified, using three phase, 16⅔ cycles, 3300 volts, for the locomotives. Most of the power is furnished from hydroelectric generators feeding the railway system through frequency-changer sets. A considerable portion of this power is furnished by the various power plants of the Società Elettrica di Ponente (Negri system), the largest of which is the hydraulic plant of San Dalmazzo, near the Franco-Italian border. This plant contains two 11,000-kva., 16⅔-cycle, three-phase, 5750-volt generators, two 9000-kva., 50-cycle, three-phase, 5750-volt generators, six 3500-kva., 50-cycle, three-phase, 5750/75,000-volt transformers, six single-phase, 50-cycle, 3500-kva., 5750/75,000-volt transformers and four outgoing lines interchangeable for either 16⅔ or 50 cycles. The generators in this section were furnished by the Allgemeine Elektrizitäts-Gesellschaft, while in an adjacent station, operating in parallel with it, the generators were furnished by the American Westinghouse Company.

At Savona, on the seacoast, is the reserve steam generating station of the Negri system, and it contains one A. E. G. turbo-generator, one Tosi steam turbine driving Siemens-Schuckertwerke tandem generators, 16⅔ and 50 cycles, and one similar set with only one generator, the second having been held up by the war. In this plant, as well as in most of the plants in Italy visited during the war, the German name plates had been removed from the machines. Owing to the high price of coal during the war the Savona station was used principally as a reserve and the units were being operated as synchronous condensers.

A typical substation of the Italian State Railways is that at Sangoni. This station, near Turin, controls two incoming and outgoing lines and contains two banks of Ganz transformers with provision for a third transformer bank. The switching equipment is Brown-Boveri, and there are four American General Electric electrolytic lightning arresters on the roof.

An important center of electrical distribution in Italy is Rome, which is supplied by hydroelectric plants at Tivoli and Subiaco, transmitting power at 30,000 volts. The Subiaco plant is of particular interest as it contains several 4000-hp., 30,000-volt units made by Ganz & Company, these being probably the highest-voltage alternating-current generators in existence.

A very flexible system of busbars is installed at the

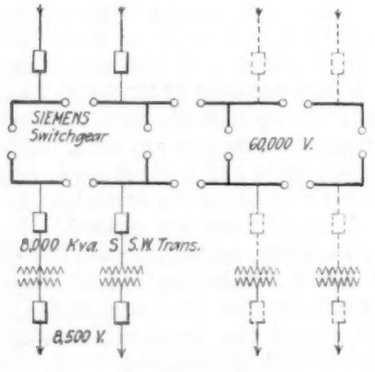


FIG. 1—BUSBAR SECTIONALIZING SYSTEM AT TOR DI QUINTO PLANT

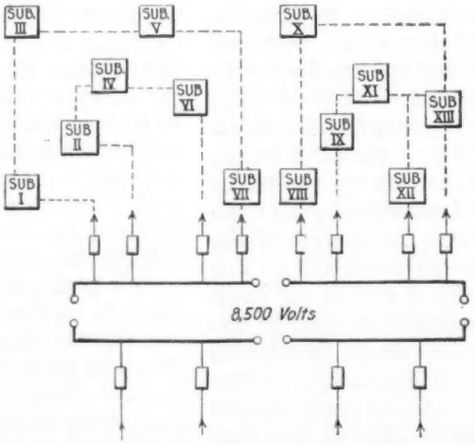


FIG. 2—CONNECTIONS OF SWITCHING SUBSTATION AT ROME

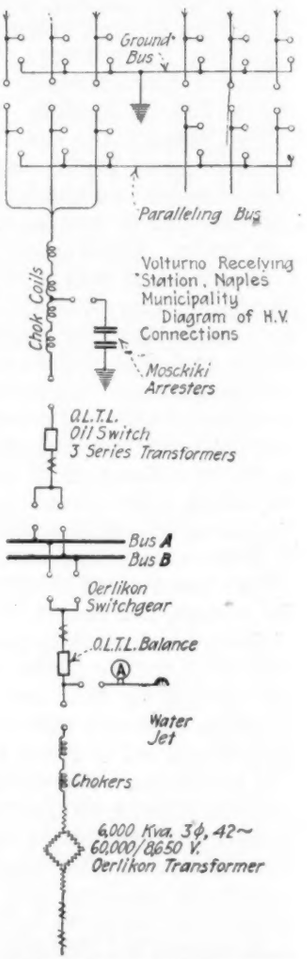


FIG. 3—HIGH-VOLTAGE CONNECTIONS AT VOLTURNO RECEIVING STATION

Tor di Quinto station, as indicated in Fig. 1, the lines and transformers being connected to a sectionalized ring busbar that is cross-connected at four points.

The Rome municipality has its principal step-down station at San Paolo, where there are two 30,000-volt incoming lines and two banks of single-phase transformers stepping down to 8000 volts. On the low-tension side of the transformer banks the current and potential transformers for metering were provided with disconnecting switches on each side.

As a reserve to the power received from Tivoli and Subiaco there are three 2000-hp. and one 1000-hp. Diesel

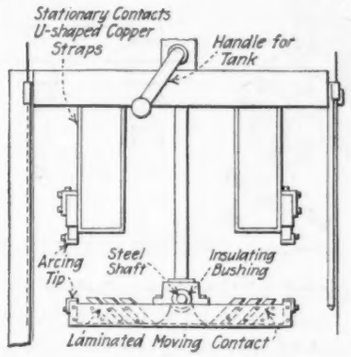


FIG. 4—FEATURES OF BRITISH OIL CIRCUIT BREAKER

units and two 5000-kva. Tosi steam turbines, one driving a Ganz generator, the other a Brown-Boveri.

There are a number of distributing substations in Rome, the connections of one of them being indicated in Fig. 2. There are four incoming lines from San Paolo and eight outgoing feeders which run in pairs around the various transformer stations in Rome so as to make four ring mains as indicated by the dotted lines. The substations in Rome are divided into four groups numbered respectively 100, 200, 300 and 400. In each group there are possibly ten or fifteen substations, and pilot wires are run from the central control point to each substation, all of the street lighting being controlled by direct current from this central control point, where a clockwork device is installed, arranged to actuate the relays in the different substations in a definite sequence.

At the San Paolo station the 8000-volt equipment is of interest. The cells are made of reinforced concrete with screens of perforated metal, with the edges bound by beading of sheet metal. In the compartment containing the oil circuit breaker there are no phase barriers, but in the compartments with the series ammeters glass sheets have been placed between phases. The ammeters are all series instruments mounted on porcelain insulators and connected in the primary leads.

Another city depending largely on hydroelectric power transmission is the city of Naples, the municipality receiving power from the Volturno generating station, 80 km. distant, at 60,000 volts, 42 cycles, three-phase. At the Volturno receiving station the main connections are indicated in Fig. 3. As may be noted, there are two three-phase incoming lines, each wire of which is provided with a single-pole switch for grounding, a single-pole switch for cutting off the line, and a single-pole switch connecting to a paralleling bus. Between the incoming line switches and the oil breaker there are four sets of choke coils with Mosckiki condensers acting as lightning arresters. There are two sets of high-tension buses and three 6000-kva., three-phase Oerlikon transformers stepping down from 60,000 volts to 8600 volts. As a reserve there were three Oerlikon Sulzer Diesel sets, rated at 1340 kva., 8650 volts, with one 250-volt, 150-hp. equipment for the station service.

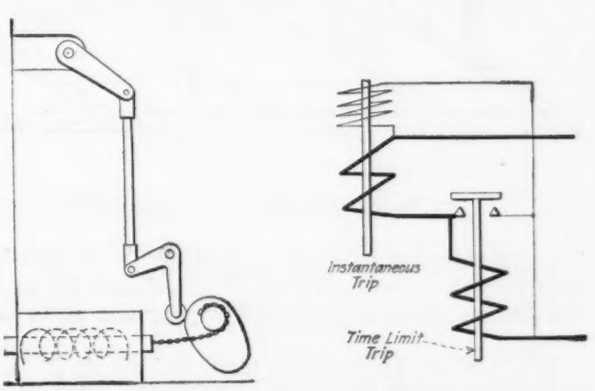
In this station all of the 60,000-volt wiring is colored yellow; the 8650-volt wiring is colored red, and the ground connections green. In other Italian stations the three phases are painted red, white and green.

In the neighborhood of Grenoble, in France there have been a number of hydroelectric developments along the Romanche, the Isère and other streams in the neighborhood. The power plants along the Romanche are close together, the tailwater from one plant practically forming the headrace for the next plant.

Near Lyons the Forces Motrices du Rhône have a generating station on the Jonage Canal containing sixteen vertical-shaft Escher-Wyss waterwheels of 1500 hp. each, driving Brown-Boveri machines originally rated at 1000 kva. but rewound for 1500 kva. Near the hydraulic plant is the steam plant, containing one Escher-Wyss-Zoelly-Brown-Boveri turbo-generator of 5000 kw. capacity, two Oerlikon units of the same capacity, one 2000-kw. Curtis and a 7000-kva. British Westinghouse. Most of the switching equipment was Oerlikon and Brown-Boveri with a small amount of Westinghouse. This system is to receive power at a later date from the Alps over transmission lines approximately 200 km. long, delivering about 40,000 kva., probably at 150,000 volts.

In addition to the alternating-current transmissions running into Lyons, high-voltage direct current on the Thury system is in operation at approximately 60,000 volts with the neutral grounded, and there has been talk of connecting in an additional direct-current generating station in series so as to transmit power at approximately 110,000 volts direct current with neutral grounded.

The power for Paris is all generated by steam stations, the largest being those at St. Ouen and St. Denis. The St. Ouen station contains eight 12,500-kva., two-phase, 12,300-volt, 41⅔-cycle turbo-generators, con-



FIGS. 5 AND 6—OPERATING MECHANISM OF OERLIKON OIL SWITCH AND CIRCUIT OF MAGRINI TRIP SWITCH

necting to a duplicate set of busbars sectionalized in the middle, and the feeders are arranged in eight groups, each of which can be connected to either set of busbars.

For many years it has been proposed to transmit power to Paris from a point on the Rhone near the Swiss frontier, a distance of about 500 km. The original proposition contemplated the building of a dam at

Genissiat 76 m. high, forming a lake 25 km. in length, and allowing the development of about 320,000 hp. An alternative proposition covered the building of two dams, one at Bellegarde and the other at Malpertuis, to divide the total head. The original intention was to install approximately 240,000 kva. in electrical equipment, transmitting about 120,000 kva. to Paris and approximately 60,000 kva. to Lyons, the remaining 60,000 kva. to be used locally for electrochemical processes.

In the Pyrenees section of France about 180,000 hp. has been developed, used principally for the Midi Railway, power transmission, large industrial plants and a number of other industries. Equipment has recently been furnished for 120,000-volt outdoor service in that neighborhood, and it is the intention to build at a later date a hydroelectric plant on the Spanish side of the border developing approximately 200,000 kva., transmitting the power into France and tying into a network that will run all along the Mediterranean coast.

In the central section of France approximately 135,000 hp. had been developed up to 1916, 35,000 hp. in the south and 28,000 hp. in the east. The total water power developed in France up to 1916 was 1,500,000 hp. with 1,100,000 hp. then being installed, 800,000 hp. being under consideration. It has been estimated that the total hydraulic horsepower available in France is in the neighborhood of 9,200,000.

British Use Draw-Out Type of Switchboard

In England there are no systems operating at more than about 20,000 volts, and the equipment as a rule does not differ very materially from American practice, except that a great deal of the draw-out type of switchboard is in service, particularly for coal-mine work and industrial plants. A large amount of this draw-out type of switch gear in England has been made by the Reyrolle company although a considerable amount has been furnished by the British Westinghouse Company, the British Thomson-Houston Company and other concerns.

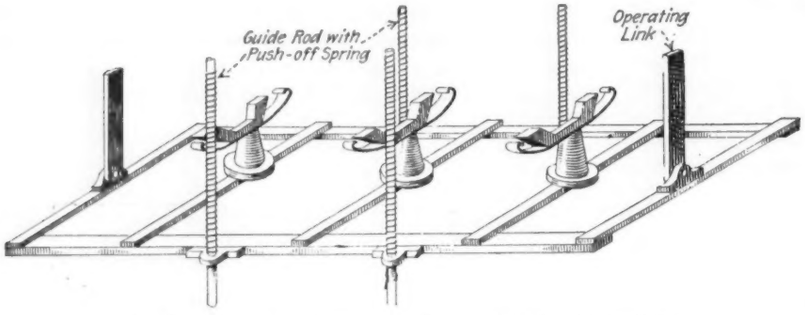


FIG. 7—MOVING ELEMENT OF MAGRINI 8500-VOLT BREAKER

The total capacity of the municipal plants in June 1914 was 500,071 kw., with 645,072 kw. installed or authorized since, while that of electrical companies in June 1914 was 315,600 kw., with 324,453 kw. added since.

According to a published statement the amount of coal used in the United Kingdom for the production of power is about 80,000,000 tons, costing approximately $200,000,000 a year. It has been estimated that by an up-to-date and national scheme of electrification 55,000,000 tons out of the 80,000,000 tons of coal can be saved with an economy of about $135,000,000 per year. At the present the supply of electricity in Great Britain is divided among about six hundred companies and municipal undertakings. The average generating capacity of each of these stations is only about 5000 hp.

This scheme of centralization of power development has been carried out to a large extent in New Castle-on-Tyne, where, apart from the electric power company's consumption, practically no coal is burned for power purposes except by the railways and some collieries.

New industries have been established in the districts solely on account of the cheap electric power available. Waste heat and gases have been extensively used for the production of electricity so that the electric power is produced as a by-product of a few of the largest local industries, the making of pig iron and coke. These local generating stations are commonly called waste-heat stations. The first was erected in 1905, and there are now eleven at work.

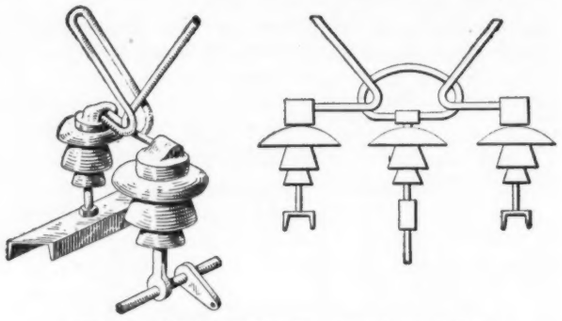


FIG. 8—HORN SWITCHES IN USE IN ITALY

Substantial Oil-Circuit-Breaker Construction

Fig. 4 illustrates some of the features of a British Westinghouse oil circuit breaker that is made in capacities up to 3000 amp. with pressures to 650 volts. The most novel feature of these breakers is the stationary contacts, which consist of copper straps bent in the form of a U fastened to the slate base. For this form of contact numerous advantages are claimed, among these being a large cooling surface exposed to the oil and the absence of joints and bare copper in its construction.

The moving contacts are of the laminated-brush form with butt arcing tips, the three sets of moving contacts for the three-pole breaker all being carried by and insulated from a horizontal steel rod to which the operating mechanism is attached. The oil tank is made of steel with a three-ply wood lining and phase barriers. For the large sizes of switches the tank-lowering arrangement is furnished. In the power plant of the Leeds municipality, where a number of these breakers are used, the cell doors are interlocked with the breaker, with the rear cell doors closing in the cubicles containing the disconnecting switches in such manner that the doors of the disconnecting-switch cubicle cannot be removed unless the breaker is in the open position, and, conversely, the doors of the breaker cubicle cannot be taken off until after the disconnecting switches have been pulled.

The switching equipment furnished by the British-Thomson-Houston Company corresponds very closely with that supplied by the American General Electric Company.

In the New Castle district there were a large number of Reyrolle oil circuit breakers used in the 20,000-volt tie circuits as well as the 6000-volt distributing circuit. Practically all of these breakers were arranged on the "draw-out" principle, so that it was impossible to get at their tanks or contacts while the breaker was alive. This was accomplished by bringing out the six terminals of a three-pole breaker through a back casting to a series of contact jaws the breaker being arranged to slide on a frame and one set of contact jaws engaging with contacts connected to the bus, the other set engaging with contacts connecting to the circuit to be controlled.

Suitable interlocks were provided that made it impossible to pull out the oil breaker until it had been tripped, and the tanks could not be dropped on the oil breaker until it had been pulled out.

The Ferranti switch gear seen in the power plant of the Leeds municipality somewhat resembles the breakers built by American Westinghouse Company, but one feature particularly noted was that the trip coil of the breakers were always shunted by a resistance which eliminated the arcing that would otherwise occur on the signal switch when the breaker tripped.

The Oerlikon Oil Circuit Breaker

Fig. 5 shows the operating mechanism of a 60,000-volt Oerlikon oil circuit breaker at the Volturno receiving station of the Naples municipality. The solenoid, requiring 2 kw. to operate it, pulls on a link chain winding up a "pull-out" spring and moving a cam which

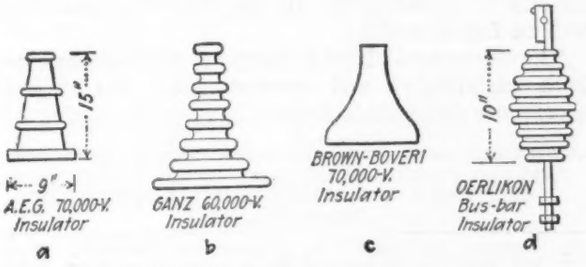


FIG. 9—CONTINENTAL HIGH-VOLTAGE INSULATORS

(a) A. E. G. 70,000-volt insulator; (b) Ganz 60,000-volt insulator; (c) 70,000-volt insulator of Brown-Boveri; (d) Oerlikon busbar insulator.

works on a roller mounted on the end of the lever. Most of the oil breakers used in Italy and France are operated by a rotary mechanism, as is indicated in this sketch.

At the Rome municipality low-tension switching substation the 8500-volt oil circuit breakers were of the Magrini make of the general construction indicated in Fig. 7. The contacts are of the brush-and-butt type, the butt contacts being of brass on the moving elements and a simple steel nut on the stationary side. The general arrangement of the moving frame which carries the brushes is shown in Fig. 7. The frame is of steel about ½ in. by ¼ in. (12 mm. by 6 mm.) and moves between the wooden lining of the tanks. The wooden lining has phase barriers, and opposite these on each side of the carrying frame are two guide rods on which are spiral "push-off" springs. The lifting levers are linked onto lugs at the extreme end of the frame.

Each of the 8500-volt oil circuit breakers has two series relays with an inverse time-limit device, going up to nine seconds and becoming instantaneous by the action of another piece of mechanism at twice full load. The general scheme is indicated in Fig. 6. The oil circuit breakers have series trip coils on each pole, each comprising two coils. The main series coil was provided with an adjustable time-limit device, and when this coil operated it opened up a small short-circuiting switch and allowed current to pass through a shunted trip coil which actually tripped the switch. A few series turns on the trip coil insured instantaneous operation on short circuit, the connection being as shown in Fig. 6 and the time-limit device being attached to the right-hand plunger, while the left-hand plunger has to rise before the oil circuit breaker is actually tripped.

Few Outdoor Substations in Europe

There are practically no installations in Europe using high-voltage outdoor breakers at present, although the Società Meridionale of Naples has lately installed an American General Electric outdoor 88,000-volt breaker at its Pescara substation, and the American Westinghouse Company has furnished outdoor 120,000-volt breakers for four transforming stations in France and a number of 93,000-volt outdoor breakers for a power transmission system in Spain.

Fig. 8 shows two types of horn switch installed outside the Bardonnechia station of the Italian State Railways and designed for the purpose of cutting off the 70,000-volt lines.

The 75,000-volt line outlets at Lavagnola consist essentially of a hole about 10 in. (25 cm.) in diameter through the window glass, the wire being supported on an insulator inside the building and on the outside connecting to the leads running to the transmission tower. At Sagoni the high-tension line was taken out through a roof bushing set in a concrete cone. These roof bushings for 60,000-volt service are oil-filled, and the oil as usual leaked. The concrete cones supporting the roof bushings were provided with little porcelain tubes, apparently for the ventilation of the high-tension room below.

Typical high-tension insulators as in use on the Continent are shown in Fig. 9.

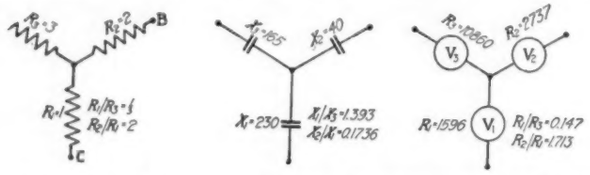
MORE than $4,000,000,000 worth of domestic manufactures were exported in the year 1917 by a country which had never sent to the outside world as much as $1,000,000,000 prior to the year 1912. Our exports of domestic manufactures never reached as much as $500,000,000 prior to 1904; they advanced to a little more than $1,000,000,000 in 1912, then responded to the demands of the war with over $2,500,000,000 in 1916 and $4,134,000,000 in 1917. Prior to the war we were supplying the total world with only about $1,000,000,000 worth of manufactures out of a grand total of $7,000,000,000 entering international trade; in 1917 we supplied over $4,,000,000,000 worth, four times as much as the value three years before and more than one-half as much as the world's total of manufactures entering international trade in any year prior to the war.—*O. P. Austin, statistician National City Bank of New York.*

Study of Unbalanced Three-Phase Loads

Graphical Method Involving Use of Abaque Which Permits Calculation of Currents and Voltages in Unbalanced Star-Connected Circuits

BY LEONARD ALLISON DOGGETT
Professor of Electrical Engineering, United States Naval Academy

THREE-PHASE circuits may be arranged in a number of ways—for example, star generator and delta load with negligible resistance in the intervening leads, delta generator and star load with appreciable lead resistance, and various other similar combinations. When these circuits are balanced, which fortunately is the case in 99 per cent of all practical



FIGS. 1, 2 AND 3—UNBALANCED STAR-CONNECTED CIRCUITS EACH LEG OF WHICH TAKES A DIFFERENT AMOUNT OF POWER

cases, the calculation is easy. When, however, these circuits are unbalanced the problem of finding the currents and voltages is both tedious and difficult. The unbalance is seldom present in power-generating apparatus, but occurs, when it occurs at all, in power-receiving apparatus, occasionally in the connecting leads.

In the first part of this article only the cases of unbalance in the load will be considered. There are two possible types of load; *i.e.*, the delta load and the star load. For the delta load a graphical solution* by means

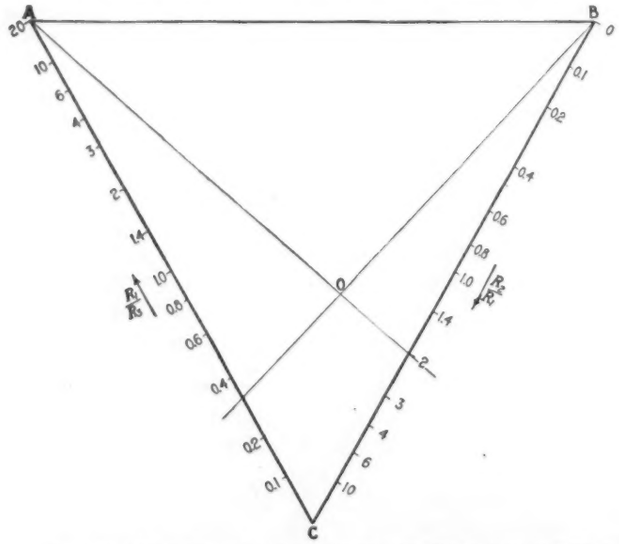


FIG. 4—ABAQUE USED IN CALCULATING CURRENT AND VOLTAGE IN UNBALANCED CIRCUIT

of vectors drawn to scale is simple and satisfactory. This method is applicable to any sort of unbalanced delta load. For the star load, however, the problem is not solvable by the method referred to above, principally because the voltages to neutral, the voltages which determine the phase and line currents, are not known† when the load is unbalanced. There is no simple method of attacking this problem—really the problem of finding the neutral in an unbalanced star load. For the case where one branch has resistance, the second branch inductive reactance and the third branch condensive reactance the easy solution has yet to appear. For the

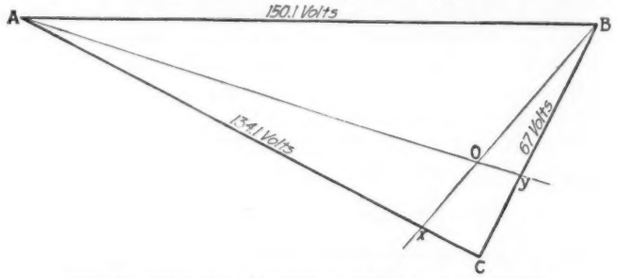


FIG. 5—EXAMPLE COMPUTED FROM DATA IN TABLE

case, however, where each branch has the same power factor but a different amount of power absorbed the graphical method given in the following paragraphs will be found useful.

The correctness of the following method can be proved both analytically‡ and experimentally, but it would seem more desirable to devote the space to making clear

DATA FOR MAKING AN ACCURATE ABAQUE TO CALCULATE CURRENTS AND VOLTAGES IN UNBALANCED THREE-PHASE CIRCUIT

R_1/R_3	Distance Out from C	R_1/R_3	Distance Out from C	R_1/R_3	Distance Out from C	R_1/R_3	Distance Out from C	R_1/R_3	Distance Out from C
0.01	0.099	0.26	2.06	0.90	4.74	2.5	7.14	5.4	8.44
0.02	0.196	0.28	2.19	0.95	4.87	2.6	7.22	5.6	8.48
0.03	0.291	0.30	2.31	1.0	5.00	2.7	7.30	5.8	8.53
0.04	0.385	0.32	2.42	1.1	5.24	2.8	7.37	6.0	8.57
0.05	0.476	0.34	2.54	1.2	5.45	2.9	7.43	7.0	8.75
0.06	0.566	0.36	2.65	1.3	5.66	3.0	7.50	8.0	8.89
0.07	0.654	0.38	2.75	1.4	5.83	3.2	7.62	9.0	9.00
0.08	0.741	0.40	2.86	1.5	6.00	3.4	7.73	10	9.09
0.09	0.826	0.45	3.10	1.6	6.15	3.6	7.83	20	9.52
0.10	0.909	0.50	3.33	1.7	6.30	3.8	7.92	30	9.68
0.12	1.07	0.55	3.55	1.8	6.43	4.0	8.00	40	9.76
0.14	1.23	0.60	3.75	1.9	6.55	4.2	8.08	50	9.80
0.16	1.38	0.65	3.94	2.0	6.67	4.4	8.15	60	.84
0.18	1.53	0.70	4.12	2.1	6.77	4.6	8.21	70	9.86
0.20	1.67	0.75	4.28	2.2	6.87	4.8	8.28	80	9.88
0.22	1.80	0.80	4.44	2.3	6.97	5.0	8.33	90	9.89
0.24	1.94	0.85	4.59	2.4	7.06	5.2	8.39	100	9.90

the use of the abaque here presented for finding the neutral. If resistances have the value and be arranged as in Fig. 1 and this star load be connected across a 100-volt, three-phase supply, the neutral may be found as follows: Having found the resistance ratios (R_1/R_3) and (R_2/R_1), these are spotted along the corresponding sides of the triangle of Fig. 4. A line is drawn from

*"Standard Handbook for Electrical Engineers," 1915 edition, page 106.

†ELECTRICAL WORLD, Vol. 34, 1899, pages 268, 413; also "Theorie der Wechselstrome," by J. L. La Cour and O. S. Bragstad, page 301.

‡This proof is most conveniently arrived at by use of expressions similar to those given in Appendix E of A. E. Kennelly's "The Application of Hyperbolic Functions to Electric Engineering Problems."

B to the R_1/R_2 spot, and another line is drawn from A to the R_2/R_1 spot. The intersection of these lines locates the neutral. The sides of the above equilateral triangle are five units long, and therefore the voltage scale for this problem is 20 volts to the unit. For this case:

$$I_1R_1 = OC = 39.7;\ I_2R_2 = OB = 65.5;$$
$$I_3R_3 = OA = 72.1.$$

Therefore

$$I_1 = 39.7;\ I_2 = 65.5/2 = 32.8;\ I_3 = 72.1/3 = 24.$$

As another example consider Fig. 2, in which three unequal condensers are arranged in star across a 200-volt, three-phase supply. These reactance ratios are similarly spotted along the sides of the triangle of Fig. 4. For this case the calculated voltages to neutral are:

$$I_1X_1 = 160.9;\ I_2X_2 = 51;\ I_3X_3 = 154.9;$$

and

$$I_1 = 0.699;\ I_2 = 1.275;\ I_3 = 0.939.$$

A third example which provides an easy experimental check of the correctness of the method is shown in Fig. 3, where three voltmeters of known resistances are connected in star. In this case the voltages to neutral, calculated from the abaque, are:

$$I_1R_1 = 57.7;\ I_2R_2 = 93.6;\ I_3R_3 = 120.1,$$

while the observed voltages to neutral are:

$$V = 57.6;\ V_2 = 93.9;\ V = 120.$$

The three-phase line voltage is 133.3.

For the benefit of those wishing to make an accurate abaque of larger scale, the table herewith is submitted. The distances on a 10-in. (25.4-cm.) triangle, correct to three figures, are tabulated for various values of R_1/R_2. The scales along the two graduated sides of the triangle are identical, the tabulated distances on one side being measured from C and from B on the other.

This method is also applicable to cases where the three impressed voltages are unequal in value and displaced from each other by unequal phase angles.

A particular example (Fig. 5) will show the application. Three wire, two-phase voltages of the following magnitudes, $E_{ab} = 150.1$, $E_{bc} = 67$, and $E_{ca} = 134.1$, were produced something after the manner of the T transformer connection. Three voltmeters of resistances $R_1 = 1596$, $R_2 = 2737$ and $R_3 = 10{,}860$ ohms were connected, R_1 to C, R_2 to B and R_3 to A. An abaque was laid off, as in Fig. 5, to the scale of 20 volts to the unit. The distance Cx is found by using the table, the tabular value corresponding to $R_1/R_3 = 0.147$ being 1.282, and therefore the distance Cx is $134.1 \times 1.282/10 = 17.2$ volts. The distance By is likewise found by using the tabular value corresponding to $R_2/R_3 = 1.713$; the distance By thus being equal to $67 \times 6.317/10 = 42.35$ volts. The abaque then gives:

$$E_{oa} = 124.5;\ E_{ob} = 45.6;\ E_{oc} = 25.2.$$

The observed values were

$$E_{oa} = 120.0;\ E_{ob} = 45.0;\ E_{oc} = 25.5.$$

Conclusion.—To find the neutral resulting when three unequal or equal alternating emfs. of any relative phase are impressed on an unbalanced star load, draw a triangle of voltages to scale and lay off along two sides scales in accordance with the law which is the basis of the table.

Distance from vertex $= 1 \div (R_3/R_1 + 1) \times$ length of side. On these scales spot the R_1/R_3 and the R_2/R_1 points. The neutral lies at the intersection of the lines drawn from these points to the opposite vertices. This method holds only with like power factors in all the branches.

Subway Lighting for New Cleveland Bridge

Characterized by Bright, Cheerful Appearance, by an Absence of Glare and Shadows, to Avoid Tunnel-like Appearance, and by Light Distribution Which Facilitates Recognition of Faces

BY WARD HARRISON AND EARL A. ANDERSON
Engineering Department National Lamp Works of General Electric Company, Cleveland, Ohio

SINCE it is expected that Cleveland, Ohio, will soon need a complete underground car system to handle its downtown traffic, and since the subway used in conjunction with the new Cuyahoga River bridge is really the first step in this general scheme, it was especially desired by the county engineers that the lighting of the bridge subway should create a favorable impression and assist in overcoming the natural prejudice against underground transportation. The solution of the latter problem, County Engineer William A. Stinchcomb believed, lay in illuminating the darkness and gloom usually connected with underground passages. His engineers therefore obtained the coöperation of the engineering department of the National Lamp Works of the General Electric Company to determine upon some lighting system which would serve its utilitarian purpose and also cause the psychological effect desired. As a result of this joint effort the effects shown by the accompanying illustrations were obtained.

The illumination of the west-side subway station is shown in Fig. 1. The lighting has the following characteristics:

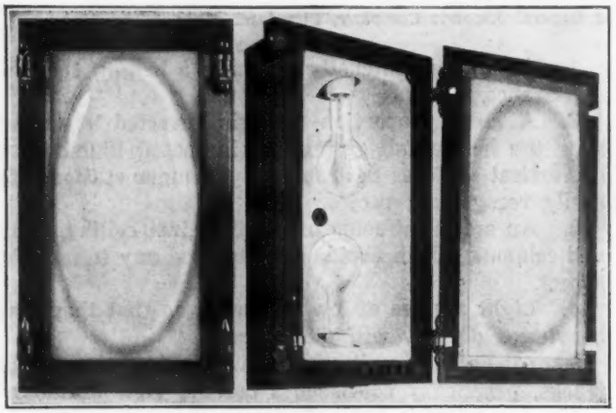
1. A sufficient intensity to create a bright, cheerful appearance.
2. A large proportion of light directed at angles near the horizontal, giving the increased illumination of vertical surfaces desirable in passenger stations for easily recognizing people.
3. An ample diffusion of light against ceiling, walls and columns, which avoids shadows and any tunnel-like aspect.
4. Light sources of low brilliancy, so that they may be viewed directly without glare.
5. All lighting units facing at right angles to the tracks, practically concealed from the view of motormen on approaching street cars.

In this station the columns are spaced approximately 14 ft. by 18 ft. (4.3 m. by 5.5 m.), and there are two flush lighting plaques on opposite sides of each column, as will be seen from the picture. The centers of the light sources are just 8 ft. (2.4 m.) from the platform. An additional box, faced downward, is mounted at the top of each of the jack arches over the passenger platforms at a height of 13 ft. (4 m.). This ar-

rangement avoids a shadowed section beneath the arches and increases the intensity there for reading newspapers.

Close-up and inside views of one of these flush-type lighting fixtures are shown in Figs. 2a and 2b. This fixture was developed by the engineering department of the National Lamp Works. James Brennan of the Cuyahoga County engineer's office worked out the mechanical design and developed the iron housing which by slight changes in the dimensions of the columns and rearrangement of the steel reinforcing bars could be set directly in the columns without reducing the strength. The fixture is designed to accommodate two gas-filled tungsten-filament lamps, one burning tip down and the other tip up. These are backed by special porcelain enameled reflectors and the light is diffused through an opal-glass panel in front. The face of the box is set flush with the surface of the wall or column. Projecting hinges for the swinging front are attached after the forms for the concrete have been removed.

FIG. 1—PLAQUE LIGHTING FIXTURES IN COLUMNS AND AT TOP OF JACK ARCHES LIGHT WEST-SIDE SUBWAY OF CLEVELAND'S NEW BRIDGE



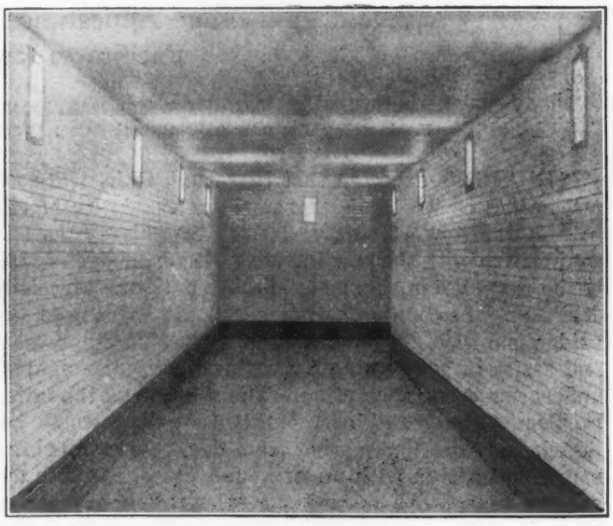
FIGS. 2A AND 2B—EXTERIOR AND INTERIOR VIEWS OF SPECIAL PLAQUE LIGHTING FIXTURE USED IN CLEVELAND

The two lamps in each box are wired on separate circuits, so that if desired in the early morning hours, when the platforms are practically deserted, the illumination may be reduced by half without unsightly effect and increased shadows which would result with a system of darkening completely every other unit, as would be necessary with single-lamp equipment. The boxes will accommodate lamps up to the 200-watt size. At present 75-watt gas-filled lamps are installed, and with them the intensity provided averages practically 1½ foot-candles.

Cross-over tunnels, as shown in Fig. 3, are illuminated by this same form of fixture. The white tile walls reflect and diffuse the light, giving a very well-lighted appearance.

It is interesting to note that, even though practically all of the units in this passenger station are within easy reach to facilitate cleaning, yet in five months after the system was put into use there was a breakage of only one glass plaque. There has been no case of lamp theft—a remarkable record of installation in a public place where there are always a certain number of mischievous loiterers. This good maintenance record is attributed to the fact that there are no lamps exposed, nor are there pendent globes of any kind to tempt missiles.

Unfortunately, the concrete work for the subway passenger station at the east end of the bridge was all in place before consideration was given to the lighting; therefore it was not possible to use the form of fixture described above. Instead, a pendent unit (Fig. 4) was developed to give the same general results by using the glass plaques for its sides and fitting a diffusing plate in the bottom to give an increased downward component such as was supplied by the units in the top of the jack arches in the other station. In this fixture the two-lamp arrangement was adhered to,



FIGS. 3—CROSS-OVER TUNNEL, SHOWING THE PLAQUE FIXTURES ADOPTED

giving an even brightness to the glass plaques and admitting of switching off half the lamps without darkening any fixtures. The appearance of the lighting installation in this station is not quite equal to that of the other station, even though the cost of the equipment was greater. The chief reasons are that the fixtures

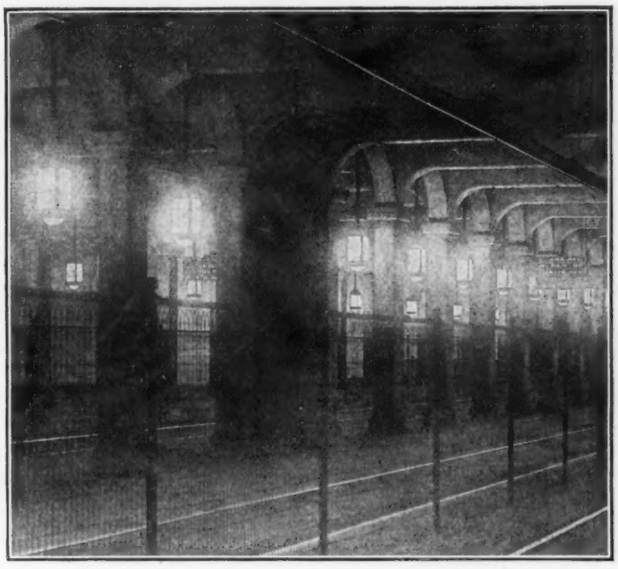


FIG. 4—ILLUMINATION FROM PENDENT LAMP FIXTURES IN EAST-END STATION

do not have the same appearance of being a part of the structure, and the conduit had, of course, to be run on the surface instead of being concealed. Besides, owing to the greater area cared for by each single unit, larger lamps were necessary and the glass plaques are brighter. In contrast with the record for the west-side station installation, there have been several of the glass plaques of the pendent units maliciously broken.

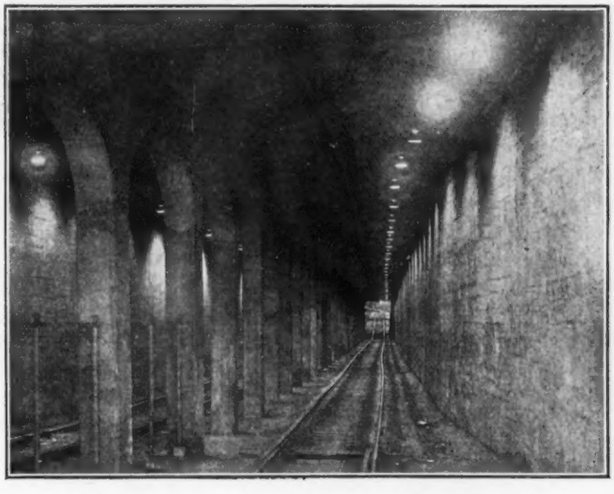


FIG. 5—ILLUMINATION OF CAR TUNNEL APPROACH TO SUBWAY STATION

In the car tunnel approaches it was necessary to provide a sufficient illumination to enable the motormen to discern any object on the tracks or see any person who should inadvertently wander into the tunnel. Moreover, it was desired to illuminate the side walls to such an extent that passengers riding in the cars should not have a sense of going down into a dark hole. With this installation 60-watt tungsten lamps were mounted at the top of the tunnel directly over the car tracks, as shown in Fig. 5. The bowl reflectors cut off all direct glare from the eyes of the motormen, and there is an even intensity of illumination on the walls over the section visible to passengers.

To obviate the dangerous possibilities when a crowded public inclosure is accidentally darkened through failure of power supply, a division of the circuits was made, energy for part of the lamps in each section of the subway stations and tunnels being supplied from absolutely independent sources of power. This safety feature has proved its value twice already, for at one time the illuminating company's power circuit was deprived of energy for a brief period of time and at another time the Cleveland municipal plant circuit was temporarily disabled. Passengers using the bridge were not seriously inconvenienced by either failure of service inasmuch as there was half of the normal illumination remaining in both cases.

The roadway and sidewalks of the upper level of the bridge are lighted with a continuation of the ornamental series incandescent lighting system in the downtown section of the city. The octagonal refractor-lantern fixture is mounted on a pressed-steed column approximately 15 ft. (4.6 m) in height. Lamps of 1500 cp., supplied from individual two-coil series transformers, are used. In the steel-arch section of the bridge a double-lamp head was developed to carry two lanterns with 1000-watt lamps on each post, thereby avoiding the deep shadows which would be cast by the steel work were single lantern posts installed in these locations.

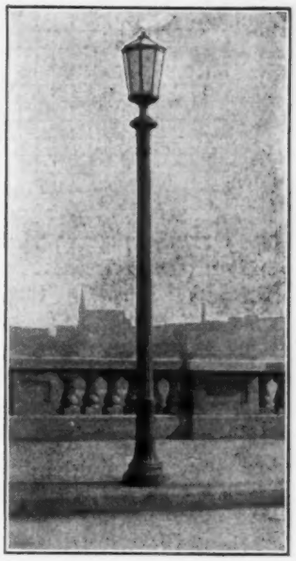
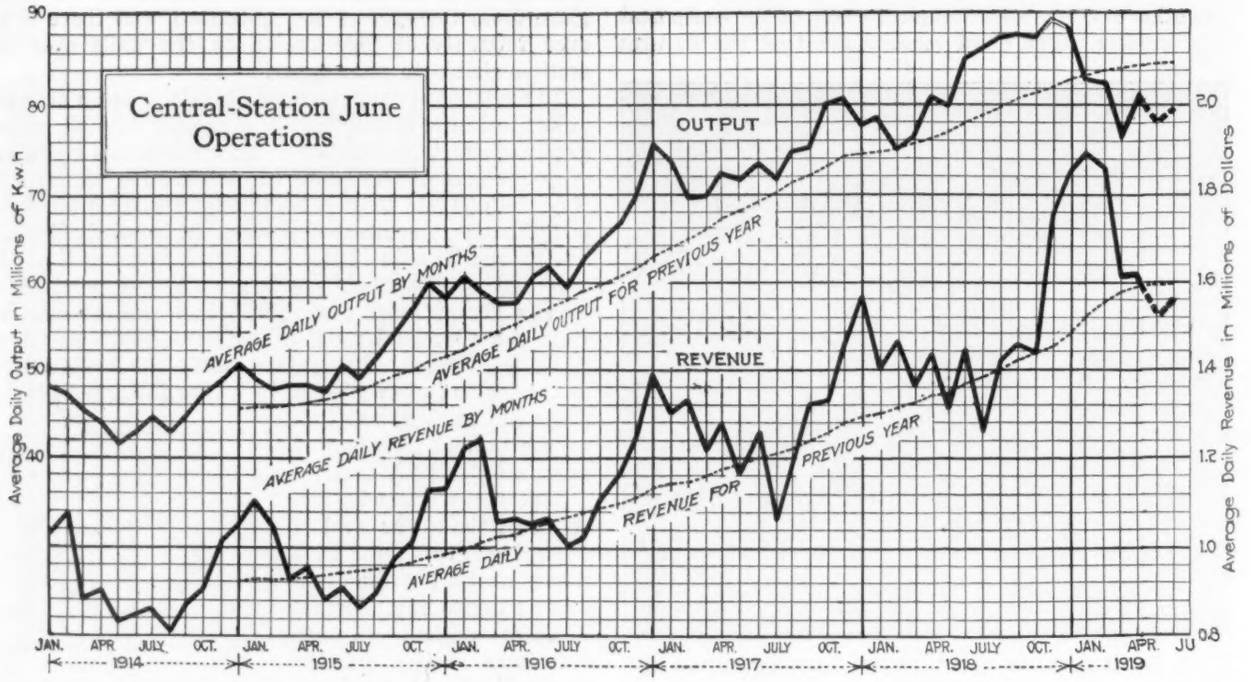


FIG. 6—WHITE-WAY LANTERN USED ON TOP DECK OF BRIDGE

The experience to date with this installation corroborates the well-known principle that good lighting decreases crime, for there has not been a single case of assault or robbery reported in these passenger stations since their completion.

I THINK there is cause to wonder whether it is morally sound to construe a law frankly intended to prevent combinations in restraint of trade so as to prevent coöperation in promotion of trade. . . . In its essential character competition is non-human and is cruel. It is ruthless, deadly. Its progress is over industrial graves. . . . We begin to see that coöperation is the end toward which our progress leads without being destructive on the one hand or dangerous upon the other.—*Secretary of Commerce Redfield.*

Revenues Show Great Stability


Central-Station June Operations
OUTPUT
REVENUE
AVERAGE DAILY OUTPUT BY MONTHS
AVERAGE DAILY OUTPUT FOR PREVIOUS YEAR
AVERAGE DAILY REVENUE BY MONTHS
REVENUE FOR PREVIOUS YEAR
AVERAGE DAILY
Average Daily Output in Millions of K.w.h
Average Daily Revenue in Millions of Dollars
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1914 1915 1916 1917 1918 1919

AN UPWARD tendency both in kilowatt-hour output and in revenue from energy sales is manifested in the returns of central-station operations received by the ELECTRICAL WORLD for the month of June. The lowest point in production of electric power since the signing of the armistice was reached in March, when the average daily production approached 75,000,000 kw.-hr., as compared with a maximum of 90,000,000 kw.-hr. per day during the flush of war activity.

Production since March has, for the country as a whole, been fairly constant. April showed a moderate increase over April last year as well as a gain over March of this year. The daily output for May was practically the same as that of April and only a little less than that of May, 1918. According to the preliminary estimates herewith presented, practically the same amount of energy was produced in June as in May, and, it should be emphasized, this amount was slightly but appreciably in excess of the production for June, 1918.

The same general trend is exhibited in central-station revenues. While the large falling-off in income that occurred in March has not been recovered,

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States		Per Cent Increase	Percentage of Industry Represented	Atlantic States		Per Cent Increase	Percentage of Industry Represented	Central States		Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States		Per Cent Increase
			1918	1917			1918	1917			1918	1917			1918	1917	
REVENUE	July	62	$3,037,000	$2,511,000	20.9	62	$9,278,000	$7,961,000	16.5	42	$4,998,000	$4,116,000	21.4	88	$4,622,000	$3,971,000	16.4
	Aug.	63	3,138,000	2,585,000	21.4	63	10,147,000	8,722,000	16.3	51	8,223,000	6,823,000	20.5	85	5,383,000	4,560,000	18.0
	Sept.	64	3,268,000	2,811,000	16.2	57	10,143,000	8,631,000	17.5	51	9,251,000	7,703,000	20.1	86	5,389,000	4,665,000	15.5
	Oct.	63	3,360,000	3,036,000	10.6	51	8,822,000	7,924,000	11.3	50	9,218,000	7,848,000	17.4	81	4,854,000	4,420,000	9.8
	Nov.	64	3,695,000	3,238,000	14.1	55	11,877,000	10,400,000	14.2	50	9,277,000	7,704,000	20.4	81	5,034,000	4,552,000	10.6
	Dec.	64	4,097,000	3,449,000	18.7	55	11,927,000	10,199,000	16.9	50	10,781,000	8,836,000	22.0	79	5,253,000	4,644,000	13.1
			1919	1918			1919	1918			1919	1918			1919	1918	
	Jan.	63	4,253,000	3,443,000	23.5	60	13,444,000	11,168,000	20.3	47	10,410,000	8,484,000	22.7	77	5,187,000	4,494,000	15.4
	Feb.	63	3,895,000	3,048,000	27.7	53	10,894,000	8,943,000	21.8	45	9,305,000	7,484,000	24.3	73	4,036,000	3,618,000	11.5
	March	64	3,608,000	3,044,000	18.4	58	11,731,000	10,244,000	14.5	47	9,012,000	7,447,000	21.0	81	4,218,000	3,685,000	14.4
	April	64	3,473,000	2,964,000	17.2	51	11,408,000	10,114,000	12.7	47	8,420,000	6,981,000	20.5	76	4,328,000	3,755,000	15.3
	May	62	3,194,000	2,800,000	14.0	51	9,430,000	8,571,000	10.0	47	8,297,000	6,888,000	20.4	77	5,468,000	4,764,000	14.7
	June	59	3,073,000	2,892,000	6.2	49	8,553,000	7,680,000	11.2	34	5,076,000	4,350,000	16.8	69	4,093,000	3,535,000	15.8
			1918	1917			1918	1917			1918	1917			1918	1917	
KW-HR. OUTPUT	July	62	135,960,000	105,373,000	29.0	62	518,566,000	439,464,000	18.0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug.	63	143,566,000	114,017,000	25.9	63	567,672,000	490,505,000	15.7	51	447,829,000	399,278,000	12.1	85	488,433,000	413,350,000	18.1
	Sept.	64	133,901,000	114,279,000	17.1	57	520,312,000	445,154,000	16.8	51	471,594,000	408,320,000	15.5	86	453,342,000	381,067,000	18.9
	Oct.	63	139,784,000	128,970,000	8.3	51	481,222,000	440,268,000	9.3	50	479,990,000	442,054,000	8.5	81	416,870,000	381,067,000	9.4
	Nov.	64	138,559,000	123,033,000	12.6	55	542,699,000	495,812,000	9.4	50	444,012,000	396,665,000	11.9	81	403,566,000	368,237,000	9.6
	Dec.	64	145,543,000	129,838,000	12.1	55	405,253,000	421,973,000	12.6	50	489,864,000	443,544,000	10.4	79	428,906,000	374,187,000	14.6
			1919	1918			1919	1918			1919	1918			1919	1918	
	Jan.	63	143,254,000	124,632,000	14.9	60	525,322,000	458,545,000	14.5	47	463,394,000	403,127,000	14.9	77	390,690,000	371,156,000	57.2
	Feb.	63	128,660,000	109,993,000	17.0	53	406,702,000	374,958,000	8.4	45	426,965,000	378,912,000	12.6	73	287,479,000	293,492,000	−2.0
	March	64	125,510,000	124,707,000	0.7	58	459,166,000	461,096,000	−0.4	47	442,591,000	423,802,000	4.4	81	330,714,000	331,769,000	−3.0
	April	64	123,211,000	118,322,000	4.1	51	382,282,000	369,701,000	3.4	47	373,116,000	345,213,000	8.1	76	329,925,000	333,405,000	−1.0
	May	62	120,949,000	122,531,000	−1.3	51	362,207,000	383,860,000	−5.6	47	389,805,000	375,944,000	3.6	77	382,637,000	385,543,000	−0.7
	June	59	112,867,000	123,004,000	−8.4	49	337,853,380	341,193,000	−0.9	34	223,526,000	205,526,000	8.9	69	324,965,000	324,438,000	0.2

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1918	1917	Per Cent Increase	1918	1917	Per Cent Increase
July	56	$21,935,000	$18,559,000	18.2	1,370,461,000	1,156,692,000	18.5
Aug.	61	26,891,000	22,690,000	18.5	1,647,510,000	1,417,150,000	16.3
Sept.	60	28,051,000	23,810,000	17.8	1,579,149,000	1,348,820,000	17.0
Oct.	56	26,254,000	23,228,000	13.0	1,517,866,000	1,392,359,000	9.0
Nov.	57	29,883,000	25,894,000	15.4	1,528,836,000	1,383,747,000	10.5
Dec.	56	32,058,000	27,128,000	18.1	1,539,161,000	1,369,542,000	12.3
		1919	1918		1919	1918	
Jan.	57	33,294,000	27,589,000	20.6	1,522,660,000	1,357,460,000	12.1
Feb.	54	28,130,000	23,162,000	21.4	1,249,806,000	1,157,275,000	7.9
Mar.	57	28,569,000	24,420,000	16.8	1,357,981,000	1,341,374,000	1.2
Apr.	54	27,629,000	23,814,000	15.9	1,278,273,000	1,240,842,000	2.9
May	55	26,389,000	23,023,000	14.6	1,255,598,000	1,267,878,000	—1.0
June	48	20,795,000	18,457,000	12.5	999,211,000	994,161,000	0.5

the revenues for the last three months included in the report show nevertheless a gratifying stability. It should be further noted that while the output of energy in those months was not materially different from that in the corresponding months of 1918, the revenues for the period were from 12 to 15 per cent greater. The fact that a kilowatt-hour of output has on the average earned a 15 per cent greater return is another element in favor of the industry in these days of rapidly mounting costs. On the whole, then, the first half of 1919, while not a period of rapid advance, has been, so far as these returns show, for the central-station industry free from serious reaction. The output of energy during the half year was practically as large as that during the first half of 1918 and was more than that produced during the entire year of 1915.

Considered as indicative of the trend of industry, the returns from various localities convey some interesting impressions of the degree of activity in many lines of business. The reports from New England for June show a continued decline in energy output which has also been reflected in moderate losses of revenue. It is noteworthy, however, that in centers of the leather industry in New Hampshire and in northeastern Massachusetts the output was sustained and was equal to, if not in excess of, that of the same month of 1918.

Recovery in Atlantic States

The Atlantic States have apparently largely recovered from the downward tendency noted in the May report for the June production, for the region as a whole was but slightly below that of the same period of 1918. The long summer days have caused the usual seasonal drop in output in the metropolitan district, where the lighting load is so important, and this normal condition has, of course, been somewhat accentuated by the extra hour of daylight in the evening. This reduction was, however, balanced by material increases in output of those utilities supplying energy in the industrial cities of central and western New York. Companies supplying the anthracite regions of Pennsylvania increased their output, but those in the bituminous coal territory in the western part of the state seem to have been less active than a year before. The textile-mill sections of the South generally showed about the same average power absorption as during last June.

To the manufacturing cities of Ohio and Michigan must largely be given the credit for sustaining the power production of the country at the level indicated in the diagram. Centers of steel and rubber and automobile production not only showed increased power consumption in June as compared with May, but in some instances the production was fully 25 per cent greater than in the previous June. The same general situation obtained farther west, in Illinois and Wisconsin, though not to the same degree.

In the iron regions of Alabama the month of May marked the low point in power requirements, with June showing a moderate increase. Power demands were brisk in the oil regions of Texas and Oklahoma, and power companies operating in the coal fields of Colorado and New Mexico showed increases in output as compared with May, although June is usually regarded as an inactive month in coal mining in this territory. In the metal-mining districts the output of energy during June was still lower than in May, a material reduction from the high-level production of the war period.

The Pacific Coast again showed striking gains in output over the previous year, and in many cases June output surpassed that of May. This increased output in the Far West about balanced declines in the Mountain States, and it gives to the Western region as a whole substantially the same amount of energy as was produced last year.

WATER JAPAN AND SOME METHODS OF APPLYING IT

A New Japan Is Developed with Water Base to Eliminate Fire Risk Connected with Those Having Inflammable Oil Base

Baking japan, as ordinarily used in the industry, consists of a "base" and "solvent." The base contains one or more of the various asphalts together with some such oil as linseed or china-wood oil. The solvents in common use are naphtha, kerosene and similar products. These solvents create considerable fire risk, especially in the baking oven, and it was to eliminate this risk that "water japan" was developed.

Water japan consists of an emulsion of japan base in water. While it is less viscous than ordinary japan, methods have been devised for applying it so that the deposit is practically free of solvent. The electric-dip method of applying water japan is adapted to small odd jobs of japanning rather than to quantity production. The water japan is put in an iron tank which is connected to the negative terminal of a direct-current circuit. The metal to be coated is connected to the positive side of the circuit. The thickness of deposit obtained depends upon the product of the current density and the time. The current at 125 volts will average about 0.8 amp. per square inch of surface to be covered. The hot-dip method is adapted to work with large quantities of castings, punchings, etc. The metal is placed in a wire basket, heated in an oven temperature of about 500 deg. Fahr. (260 deg. C.) It is then cooled to about 400 deg. Fahr. (200 deg. C.) and quickly plunged into cold-water japan.

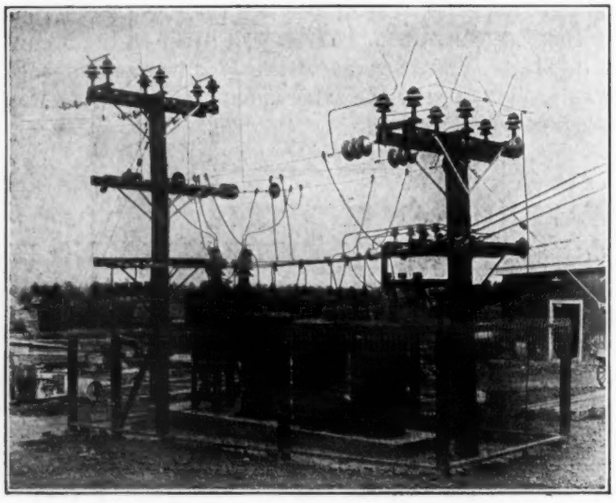
These methods are fully described in the *General Electric Review*, August, 1919, by Wheeler P. Davey, who was chiefly responsible for the development of water japan.

High-Tension Service to Large Consumers*

Close Co-operation Is Needed Between Engineering, Operating and Commercial Departments to Perfect Standard Plan for Giving Proper and Economical Service to Large Users from High-Tension Lines

BY RAWSON COLLIER
Operating and Sales Manager Georgia Railway & Power Company, Atlanta

IT IS often difficult to decide whether the ideas of the sales department or the operating or engineering department should prevail when it comes to the delivery of certain types of service to our customers. Until recent years the majority of the large consumers on the lines of our central stations were located in the congested districts of our cities, where they were supplied either from underground alternating-current or direct-current feeders at low voltage or from semi-high-tension distributing lines through manhole or vault-type transformers. Metering was generally done at low voltage, and the practice generally was for the central station to furnish, install and maintain the necessary transformers, the rates quoted being supposed to cover all the various items entering into this type of service.



SUBSTATION RATED AT 150 KVA., 19,000/2300/550 VOLTS

When the utilities began to build out from the cities, with their high-tension transmission lines, and delivery at the customer's premises was often made at from 6000 volts to 44,000 volts, new problems at once presented themselves to the sales manager as well as to the engineer.

In the case of large consumers it was almost always the case that central-station energy had to compete with isolated steam plants in production cost, and as the larger the consumer the lower his isolated plant generating cost per kilowatt-hour, so the unit price of the central station had to be lowered and every inducement had to be offered to the prospective customer in order to get his business.

I am sure that a careful study of many existing large contracts between manufacturers and central stations will show that the customer is buying energy at less than its actual delivery cost to the central station, simply because the central station was too eager to obtain "big business" and failed to take into consideration the fact that the unit cost per kilowatt-hour on long-distance transmission lines and step-down substations and the energy loss in such transmissions and transformations should play an important part in deciding whether or not the rate obtained from the consumer is a profitable one.

I know of no case where energy is delivered to ordinary wholesale commercial customers at a voltage exceeding 44,000 where the reduction to usable voltage is handled by the consumer. This is doubtless the limiting delivery voltage at present, as it is about the highest voltage for which standard high-tension customers' transformers are being built in moderate sizes, and it is practically the limiting voltage for standard moderately priced oil-break and disconnecting switches and for customers' primary watt-hour metering outfits.

Generally, in serving a manufacturing center, if remote from the generating station, the central station finds it advisable to transmit at high voltage to a central point, where a line distributing bank of transformers is installed, from which the district is served through high-tension customers' feeders, operating at voltages ranging from 19,000 to 44,000.

Some companies operating in territories only moderately populated have found it advantageous to operate lines at 38,000 volts to 44,000 volts of as much as 60 miles in length, the service being perfectly satisfactory for total connected loads as high as 6000 kva., with momentary demands of 4000 kva. Over such a line under ordinary circumstances there will be delivered during the year approximately 10,000,000 kw.-hr. The data from such a line in actual operation show that the total cost of transformers and stations, installed, is approximately $100,000. Interest, depreciation and upkeep on these transformers represent approximately $20,000 a year. If the company had to own and operate these transformers, its delivery cost per kilowatt-hour to the customer, due to overhead and maintenance charges on transformer stations, would be increased approximately 0.2 cents.

FIGURING ISOLATED PLANT COSTS

The customer in figuring his isolated-plant construction and operation cost should start with his coal bunkers and his coal pile and figure the cost of his finished power from this point through to the point where it is used. Is it not correct, therefore, that in figuring the cost of purchased electric power to the same consumer he be expected to pay for and maintain everything from the high-tension line (the crude power) to the point where the power is used? This would place the delivery to all wholesale customers on the same basis, and the customer would bear the expense of changing the current as received to any voltage that he might desire for his operation.

The objection might be advanced that the average customer is not prepared to maintain and keep in repair a high-tension transformer station, but this can easily be handled by the company furnishing free periodic

*Abstract of a paper read at the sales managers' convention, Association Island, N. Y., Aug. 4, 5 and 6.

inspection service of the customer's station and the customer paying for all necessary work that the company does on the station in order to keep it in first-class condition.

At this time I have been able to obtain the ruling of only one public service commission on the subject of who should furnish the high-tension station. It is in general as follows:

In the opinion of the commission, a company attempting to serve the public with a particular kind or class of service should furnish all the instrumentalities for so doing. However, in view of the fact that the customer has it in his hands entirely as to the length of time that he (the customer) shall use the service of the company, and in order to protect the public from the company's making an unwise expenditure of money in furnishing a particular type of transformer to meet the peculiar needs of any individual customer, and such particular customer later deciding, after a short trial, to go back to isolated-plant operation, the commission holds that the customer should provide the transformers.

Fortunately for the sales department where the customer is a large one and where the sales rate of necessity must be low in order to obtain the business, it is found that the cost per kva. of transformer capacity rapidly diminishes as the station grows larger and the load factor is generally higher for large than for small consumers. These two facts, therefore, tend to reduce the increase in the kilowatt-hour cost to the large consumer where he owns the step-down transformer station and where he actually adds to the rate paid for electricity the overhead and operating costs of his step-down transformer station. The following table illustrates the point:

Size of Station	Transformer Cost	Transformer Cost Per Kva.	Total Station Cost per Kva.
45	$1,215	$27.00	$36.00
150	1,920	12.80	18.00
1,000	5,100	5.10	14.76
2,000	8,200	4.10	12.50

	Yearly Expense Station Maintenance	Yearly Kw.-Hr.	Yearly Maintenance Expense per Kw.-Hr., Cents
45	$324	74,000	0.43
150	540	200,000	0.27
1,000	2,561	3,200,000	0.08
2,000	4,000	6,000,000	0.07

If, therefore, the customer is to be expected to furnish the substation and if the upkeep and overhead costs of the station are to be charged by the customer against his power cost, the closest coöperation between the sales department and the engineering and operating departments will be needed, both in the design and in the operation of the station, as the yearly station overhead and maintenance expense must be kept down if the business is to obtained and retained.

The best design for a customer's transformer station has been carefully studied by a number of the larger companies during the past few years, the idea being to build the cheapest station possible consistent with first-class engineering practice. Early designs of stations showed a leaning toward wooden-pole structures, but it was soon found that this was unsatisfactory except for small unimportant stations. Repairs and upkeep on the wooden structures were frequent, and it often became necessary to interrupt the customer's service in order to replace burned-off pins or cross-arms or to replace poles. Naturally, therefore, the design drifted to a steel or iron structure, and immediately the installation cost per kva. and consequently the unit kilowatt-hour cost covering interest and upkeep increased greatly.

No standard substation design of moderate cost and of substantial and flexible construction has been brought out. There are several designs of "ready-built" structures on the market, but as a general proposition they are comparatively expensive, and in many cases their design and equipment will not fit into the standard construction details of the company wishing to use them. This necessitates the carrying of special repair parts, such as switches, lightning arresters, etc.

The illustrations show to a certain degree the practice as carried out in some of the wholesale companies. It will be seen from these photographs that the general practice is to build stations for installations up to 100 kva. with a wooden-pole structure, using angle-iron or pipe structures for stations above that capacity. The great difficulty that has been encountered is in designing a flexible station—a station that can be used for a medium-sized installation but later expanded cheaply and easily to accommodate additional capacity. Moreover, it is desirable to have the steel work and bus work so designed that they need not be scrapped in case the station is enlarged or discarded.

The ideal high-tension customer's substation may be said to be that substation that fulfills the following requirements: Low first cost, low upkeep cost, flexibility, safety in operation, accessibility of meters and switches, and ability to adjust delivered voltage between commercial variations.

I will touch in a general way on the main construction details of the average customer's station with a view of bringing to attention the three points that have a bearing, in so far as customers' substations are concerned, on the delivery of continuous and satisfctory service:

Transformers.—For a moderate-sized station oil-insulated, self-cooled transformers will prove most satisfactory. Such tranformers may be specified to meet the standard A. I. E. E. specifications. Some companies, however, are requiring special taps, special voltage tests, etc. I quote as follows from a report made by one large company regarding its specifications: "We follow fairly closely the A. I. E. E. specifications, except that the temperatures are based on 35 deg. instead of 50 deg. rise; voltage tests practically the same except on the secondary test, where we demand a higher voltage test. On the 110,000-volt transformers we have 2½ per cent taps, in steps from 110,000 to 74,000; on the 44,000-volt transformers we step down to 36,000 volts in drops of 1000 volts."

The specifications covering transformers of another wholesaling company are in part as follows:

General—Use: Transformers to be used on 38,000-volt "Y" grounded-neutral, 22,000-volt and 11,000-volt circuits from substations connected to 110,000-volt transmission lines. Transformer will not be used in connection with choke coils. Transformer to be oil-insulated, self-cooled.

Tanks.—Fittings: Shall consist of gage glass, drain valve (located on name-plate side), sampling valve (located at bottom of tank and brought out opposite drain valve, size ½ in.—12 mm.), filtering valve (located at top of tank on side opposite drain valve, size ¾ in.—18 mm.). Globe valves to be used throughout, equipped with nickel-steel seats and removable hand wheels.

Design: Shall be such as will permit of convenient handling with jacks and rollers when transformer is assembled in case and case filled with oil. Base of tank shall be provided with lugs or recesses to permit the use of jack or pinch bar without requiring the use of wedges. Shall be provided with eye-bolts or other device for use in fastening slings or hooks with which to facilitate handling fully

assembled transformers filled with oil by the use of hoisting or other equipment of like character. These devices shall have ample factor of safety. Base of tank shall be drilled and tapped for ⅝-in. (15-mm.) cap screw on name-plate side to provide for ground connecton.

Dry Air: Shall be maintained by the use of anhydrous calcium chloride in proper container which shall be installed at factory on all transformers of 250 kva, and over.

Windings.—Over-Potentials: Shall be so designed that they may be operated continuously at 20 per cent above normal potential rating with normal kva. output.

Taps: Four 2.5 per cent capacity taps shall be provided for the 22,000-volt winding, making two 5 per cent full-capacity taps available when connected for 11,000 volts. Taps shall not be placed in line ends of windings.

End Turn Insulation: The high-tension winding shall have a heavily reinforced insulation on each end of the winding leading to the line, this reinforced insulation extending back to a depth of 5 per cent of the total turns of the winding.

Terminal Board: Shall be of such design as to permit the tap terminals to be placed in straight lines, the outer terminals being for the high voltages, and moving the straps in toward the center for the lower voltages. All fittings on terminal board shall not be more than 12 in. (0.3 m.) below the surface of the oil when tank is properly filled. Wing nuts or other suitable terminal fastenings shall in all cases be used, permitting changes to be made in connections without the use of tools. Terminal board shall be provided with fiber edging strip, which shall project above the edge of the board at least ½ in. (12 mm.)

Assembly: Winding and core shall be so assembled that twenty times normal full-load current may be momentarily impressed upon them without causing distortions which would result in damage to the transformer. Assembled winding and core shall be provided with suitable eye-bolts for lifting the core from the tank, the eye-bolts to be near enough the oil surface to be found by inspection without lowering the oil.

Temperatures.—Operating temperatures shall be determined in accordance with A. I. E. E. Standardization Rules, edition October, 1916.

Factory Tests.—Shall be made in accordance with A. I. E. E. requirements for this class of apparatus.

Oil.—Assembled transformers shall be filled with the proper amount of the best grade of transformer oil, this oil to be placed in the transformer case at a time in the assembly or final test of the transformer which is found to be productive of the best results in securing the maximum insulating value.

Transportation.—Transformer shall be shipped from factory with full amount of oil in transformer tank; equipped with calcium-chloride container connected properly and filled with proper amount of calcium chloride; all necessary valves, thermometers and oil gages installed and ready for service; with or without bushings as conditions may require; with proper protection from damage from handling during transit.

The manufacturer must guarantee the folowing condition of transformer upon its arrival at destination: Mechanical and electrical condition perfect, the oil to be free from moisture and of a dielectric strength equal to a test of 40,000 volts, frequency 60 cycles, between two ½-in. (12-mm.) smooth disks, with a separation of 0.2 in. (5 mm.).

Purchaser agrees to draw one-half pint sample of oil from the bottom of each transformer tank as soon as it arrived at destination, and forward to the manufacturer for test.

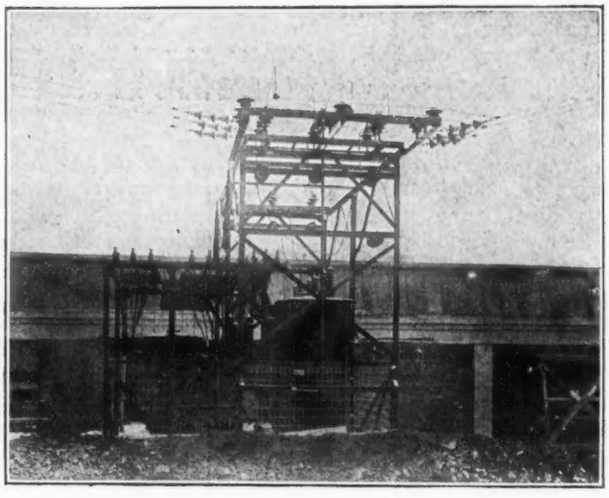
Foundations.—(For all except pole-type stations.) Concrete foundations to extend well above any possible high water line. It is much cheaper to handle, test, change or filter a transformer if it is kept near the ground; therefore the placing of large transformer on steel or wooden structures high above the ground is to be discouraged.

Switches.—Disconnecting switches should be installed on the high-tension side of the transformers. Preferably these switches should be operated from the ground by suitable lever, which can be kept locked if customer desires. By the use of these switches the customer can disconnect the station from the line when the station is not in use or when there is work to be done on it. The low-tension side should be equipped with suitable oil-break switch, equipped with overload and no-voltage-release coils.

Lightning Arresters.—The item is extremely difficult to handle, especially if the station is placed in an isolated locality where competent help cannot be obtained. Electrolytic lightning arresters are expensive and need daily attention, therefore are used on only the large and expensive stations. Horn-gap arresters, while of some assistance, do not afford perfect protection.

A report from one operating company says: "Our lightning protection is left to the ground wire on the transmission system and choke coils at the substations."

Another company reports: "We no longer place faith in fused horn-gap lightning arresters on 11,000-volt to 38,000-volt lines. We have bridged our fuse gaps with heavy copper wire and now treat the customer's substation as a part of the semi-high-tension distributing system. We find that we have fewer interruptions to the customer's service."



SUBSTATION WITH THREE 667-KVA., 19,000/550-VOLT, AND THREE 200-KVA., 550/220-VOLT TRANSFORMERS

On the low-tension side, if necessary, lightning protection can be had from a number of well-known arresters.

Meters.—Metering seems to be almost universally done on the low-tension side of the transformers. Some companies established the rule of metering on the high-tension side at voltages ranging from 11,000 to 38,000, but later a few of those companies decided to stand the transformer losses and meter on the low-tension side of the transformers, rather than pay the large difference in the cost of the high-tension metering outfits and chance the increase in maintenance cost due to the high-tension outfit being destroyed by lightning.

Below is a table showing the difference in cost to one operating company in high-tension and low-tension metering, the data covering four years operating:

Kva. Capacity of Transformers	Cost of Meter Installation High-Tension 11,000/22,000 Volts	Low-Tension 550 Volts	Maintenance per Year High-Tension	Low Tension
100	$762.00	$225.00	$60.00	$3.00
500	762.00	225.00	60.00	3.00
1,000	762.00	225.00	60.00	3.00
3,000	762.00	225.00	60.00	3.00
	22,000/38,000 Volts			
3,000	$1,600.00	$225.00	$400.00	$3.00

Transformer Loss to Central Station by Metering on Low Side (Approximate)

	Kw.-Hr. per Year
100 (11,000/22,000 volts)	17,000
500 (11,000/22,000 volts)	86,000
1,000 (11,000/22,000 volts)	173,000
3,000 (11,000/22,000 volts)	520,000
03,000 (22,00/38,000 volts)	520,000

GENERAL SUGGESTIONS

The following suggestions are made with a view of calling to your attention some points that may aid in giving continuous and satisfactory service to your high-tension customers:

(a) Insist that transformers, lightning protection and switches on the station, installed by the customer, shall conform to standard specifications as prescribed by your company. By so doing you will tend to eliminate any undue weakness in the station that might cause a short circuit or ground and thus shut down your transmission line and cut off service to other customers.

(b) Standardize on one or two voltages for your power consumers, and insist that transformers and other apparatus conform to these voltages. In case of trouble to the customers' apparatus you will then be in a position to make quicker repairs, or you can loan from your stock transformers, motors, switches, etc. until the damaged apparatus can be repaired.

(c) Demand that the customer maintain as high power factor as is consistent with first-class engineering and operating. If his type of machinery or his operating tends to reduce the power factor below that allowable for first-class operation, require the customer to install necessary machinery to rectify the trouble.

(d) Make periodic inspections, free, of the customers' transformer station, and if trouble is found, notify him immediately and make repairs promptly, at his expense.

(e) Generally, the customer will desire that his transformer station be erected by your company. If so, design and build him the most economical station possible, taking into consideration first-class engineering and operation.

(f) If possible, do all work on your customer's station without interfering with his operation. If your company does not do live-line work, try to make repairs or changes on Sundays, nights or holidays, first always getting permission from the customer in writing before taking the current off his station.

(g) Generally large manufacturing plants desire to know their power costs for each month. Try, therefore, to read the meter on the last day of each month, so that the bills rendered will cover an actual month's service.

(h) Insist that your customer is furnished with the correct voltage for his apparatus and that the regulation is within commercial limits. Much of your wholesale business is obtained because of the fact that the amount of manufactured product is increased, owing to the fact that electrical drive is steadier than the drive obtained from reciprocating engines or even most turbines. In some cotton mills the output is increased as much as 10 per cent with the same power consumption, owing to the change from isolated plants to central-station power. If the voltage or frequency is low or the regulation is poor, this saving quickly disappears. If momentary interruptions occur frequently, the loss in production or the breaking of machinery will soon cause the advantages gained by central-station electric drive to disappear.

There is absolutely no doubt that the wholesaling of energy to large consumers can be made extremely profitable if we give that type of service the thought that has been given during the past to retail business. Let us therefore try to standardize our service to our high-tension customers, striving at all times to make such service as nearly as possible free from interruptions and variations. No man in the central-station organization should know better than the sales manager what is necessary in the way of service and equipment in order to have a satisfied customer. Therefore, only by the closest coöperation between engineering and operating departments and the sales department can we hope eventually to work out and perfect a standard plan for properly and economically serving our high-tension customers.

LIMITATIONS IN THE USE OF TERM "SYNCHRONOUS HORSEPOWER"

Calculations May Show that Two Motors Have the Same Synchronous Horsepower, Although Their Starting Torques May Be Quite Different

It often happens that no distinction is made between the two terms "synchronous horsepower" and "torque." Quite frequently the former is used when the latter is really intended. Torque is the actual turning or twisting effort exerted by a rotating element on its shaft or pulley and is entirely independent of the speed at which said element rotates. It is usually expressed in pounds at 1-ft. radius. Synchronous horsepower is the horsepower that would be developed by the revolving element if it were rotating at synchronous speed and with the given torque.

An understanding of the true difference between synchronous horsepower and torque may be derived from the following: Consider two motors of the same nominal rating, but of different speeds: 20 hp. at 1200 r.p.m. (synchronous) and 20 hp. at 900 r.p.m. (synchronous). In each case tests show that the motor is capable of exerting a maximum starting torque of 30 synchronous horsepower, or one and one-half times the normal, with normal voltage impressed on the terminals of the machine. This statement is correct, but at the same time it may not convey a clear idea as to the actual turning effort exerted by each machine on its respective shaft or pulley.

Take the following equation:

$$T = \frac{\text{Hp.} \times 33{,}000}{2\pi \times S}$$

where T = pounds torque at 1-ft. radius, hp. = horsepower, S = r.p.m. Applying it to each individual case as cited above, one gets for the maximum starting torque in pounds at 1-ft. radius:

20 hp. at 1200, $T = \frac{30 \times 33{,}000}{2\pi \times 1200} = 131$ lb. at 1-ft. (18 kg. at 1 m.) radius.

20 hp. at 900, $T = \frac{30 \times 33{,}000}{2\pi \times 900} = 175$ lb. at 1-ft. (24 kg. at 1 m.) radius.

From this it is seen that the low-speed motor or the larger motor exerts the greater turning effort, and if static torque curves were taken on these motors, the results obtained would agree with what the above equations have given. It should be noted that while the low-speed motor develops the greater torque, the product (torque multiplied by speed) or power is the same for both of them. Also if the motors were fitted with pulleys of diameters such as to give the same belt speed in either case, the pull on the belt would be the same for both motors.

This suggestion was contributed by Frazer Jeffrey of the Allis-Chalmers Company, Milwaukee, Wis.

How Can A. I. E. E. Increase Its Revenue?

Outline of Needed Increases in Institute Revenue in Letter by President Townley to Membership Asking for Comments in Favor of or in Opposition to Report of Development Committee—Additional Comments on Report

IN ACCORDANCE with the recommendation of the board of directors of the American Institute of Electrical Engineers, at a meeting held Aug. 12 (as reported in the ELECTRICAL WORLD of Aug. 16, page 374), the full report of its development committee has been presented to the membership. This report has been mailed in pamphlet form accompanied by a letter from Calvert Townley, president of the Institute. In that letter President Townley outlines in considerable detail the financial situation of the Institute and gives estimates of the needed increase in revenue in order to carry out the changes in Institute activities that have been proposed. This increase is placed at $71,500. The present revenue of the Institute, as shown by the annual report for the year ended April 30, 1919, of about $135,000, President Townley states, is required to defray current expenditures. The total revenue needed to carry out the proposed plans, therefore, approximates $206,500.

PRESIDENT TOWNLEY'S THREE QUESTIONS

Three questions are asked by the president in explaining the possible ways of securing an increase in revenue:

1. Shall we increase our dues?
2. Shall we seek to obtain additional revenue from some other source?
3. Or shall we forego some or all of the proposed new activities?

The first question is considered by the president as "unpalatable" and the third question is referred to in the following statements: "Even if we do not expand, we shall still be confronted with the increased high cost of living, so that even a 'stand-pat' policy is impracticable. We must either provide additional revenue or curtail."

In connection with the second question, reference is made to the publishing policy of the Society of Mechanical Engineers and the expansion of its monthly publication into a journal of standard periodical size (9-in. by 12-in.) and the increase of its advertising clientèle. The president states that this interesting object lesson caused the development committee to propose an aggressive advertising policy for the Institute. He points out that the only way in which such an advertising policy will affect the editorial policy is that in order to receive advertising support a publication must be issued that will be read.

In closing his letter, President Townley mentions that the publication question has been referred to a special publications committee which is already at work. He believes that if any change is to be made in the practice of the Institute there would be an advantage in making it effective Jan. 1, 1920. He therefore urges that members express their views either in support of or in opposition to the report of the development committee so that the publications committee and board of directors can fully consider all suggestions at the October meeting of the board. The communications are desired at the earliest possible date and not later than Oct. 1.

The letter from the president of the Institute, dated Aug. 19, 1919, is given as follows in full:

To the Membership of the American Institute of Electrical Engineers.

In connection with the forthcoming year's activities, and with particular reference to the recommendations of the committee on development, it is essential that a careful study be made of our finances, and while, in advance of such a study, no accurate figures are available, some approximations must be before us, otherwise intelligent consideration cannot be given to the questions on which the opinions of all members have been invited. Therefore I hope you will consider that I am justified in laying before you the following information:

A reference to the last annual report shows that our revenue for the year ended April 30, 1919, was $134,944.32 and that practically this entire sum was needed to defray current expenditures. The Institute, like every other organization, has now to face the increased and still increasing costs of operation, and it is therefore certain that, even if we are to continue our activities unchanged, a larger expenditure will be required in the future than has been necessary in the past. It has in fact come to my knowledge that at least two other national engineering societies are seriously considering an increase in their dues in order to provide for this increased expenditure.

Communications to the development committee have clearly demonstrated that there is a strong general sentiment throughout the membership in favor of progress and expansion in order that the Institute may keep up with the times and be alive to its possibilities, so that it can retain the prestige which its past record has secured, and can remain, as we all want it to, one of the leading engineering organizations of the nation. Nothing is more certain than that increased activity means increased expenses, and it must therefore soon be decided how far our activities are to be limited by our pocketbook and what if any means shall be adopted to increase our income.

Coöperation of the Institute with the other national engineering societies and with local bodies, as a means of increasing the usefulness of the engineer in public affairs and his advancement as an individual, has been almost universally demanded, not only by our own membership, but by the membership of the other three national societies as well; but such an effort will not only be barren of results but will in fact bring ridicule and contempt upon the profession by failure if it shall not be backed with the necessary sinews of war. The amount of money required for this activity will, of course, be determined by its extent, and no present figure can be better than a guess. However, judging by two years' experience on the Engineering Council, hampered from the beginning by lack of funds yet called upon to occupy an ever-widening field, $15,000 per year would be a modest estimate of the Institute's share of this expense.

Another almost universal desire of our membership is that the central organization and the sections should be brought into closer contact. As a means of accomplishing this purpose, your development committee has suggested the holding of Institute and board meetings more generally in different parts of the country, also that geographical divisions be created with a vice-president from each, whose duty in addition to attending board meetings shall include a tour of his division at least once a year. The American Society of Civil Engineers, with a total membership a little smaller than ours, has created thirteen such divisions. If it shall be found that the same number will suit our requirements, we will have thirteen instead of six vice-presidents and therefore seven additional board members. In order to help insure the attendance of board members at board meetings, your development committee has recommended that their traveling expenses be paid, as is now done by both the American Society of Civil Engineers and

the American Society of Mechanical Engineers, which recommendation, along with that for the payment of the vice-presidents' expenses when visiting the sections in their respective divisions, would probably require an annual outlay of approximately $18,000.

Suggestions from the membership as to changes in our publications are many and varied, but practically all of them favor the printing of some kind of additional matter and, of course, every extra printed page means extra expense. The extent of such expenditure obviously cannot be determined until some definite plan has been proposed, but for the purpose of having some figure before us suppose we estimate that the increased cost of the publication will be $25,000 per annum.

The additional cost of running the Institute without change is not easy to predict, but a 10 per cent increase would certainly not be regarded as abnormal, *i. e.*, $12,500.

Summarizing the foregoing figures, we therefore have

Coöperation with other engineering societies	$15,000
Traveling expense of board members	18,000
Increased cost of publications	25,000
Increased cost of operation	13,500
Total	$71,500

or an increase of over $7 per member for a membership of 10,000.

The foregoing figures are confessedly approximate and inserted for the purpose of illustration only, but it is fairly safe to say that the increased annual costs will in no case be less than $5 nor more than $10 per member, and therefore the question at once arises, where is the money to come from?

Shall we increase our dues, shall we seek to obtain additional revenue from some other source, or shall we forego some or all of our proposed new activities? Even if we do not expand, we shall still be confronted with the increased high cost of living so that even a 'stand-pat' policy is impracticable. We must either provide additional revenue or curtail.

Members of the Society of Mechanical Engineers have solved a similar problem for themselves by expanding their monthly publication into a journal, using the so-called standard periodical page —9-in. by 12-in.—and by securing a substantial increase in their advertising clientèle. As a result their financial problems, at least for the time being, are behind them, no increase in dues is thought of, and they are not only willing but able to give to their membership every one of the advantages which we so dearly covet but which as yet we cannot afford. I am informed that when the expansion was first suggested it was vigorously opposed by a large number of members of the American Society of Mechanical Engineers, but that the question now receiving consideration is whether or not the publication shall be made into a weekly instead of a monthly. There seems to be no thought of going back to the old order.

"What man has done man may do," and this experience of our sister society furnishes us with an interesting object lesson. Your development committee felt that an aggressive advertising policy conducted along the proper lines, and on a high plane was in no sense inconsistent with the maintenance of our past and present high standards, of which we are at the same time both so jealous and so proud. No essential difference could be detected between the ethics of our present advertising policy, now sanctioned by long practice and yielding last year about $8,000 gross, and a more intensive application of the same policy which might be expected ultimately to yield several times that figure. As contrasted with the unpalatable alternative of adding possibly $7 to our annual dues, the committee was of opinion that the membership would have strong preference for increased advertising, and it framed its report accordingly.

It should be, of course, clear that an advertising policy and an editorial policy are two distinct matters and must not be confused. We may or may not like the *Journal* of the mechanical engineers. We may favor any one of the many suggestions offered for the improvement of our own *Proceedings*. Such questions should be decided on their own merits and not confused with the ethics of advertising. The only way in which our advertising policy will affect our editorial policy is that, on the one hand, if we expect to receive advertising support we must issue a publication which will be read, and, on the other hand, if we do not get increased advertising revenue, we shall have no money to pay for any sort of publication expansion.

Such economies as have been proposed in printing and distributing papers and in avoiding duplicate expense in issuing the *Transactions*, even if they could be all fully realized, would still fall far short of securing the revenue which now seems essential.

In accordance with the resolution of the board of directors at its August meeting, the publication question and all communications from every source relative thereto have been referred to a special publications committee, which is already at work. If any change is to be made in our practice, there is an obvious advantage in making it effective Jan. 1, 1920. The next board meeting is scheduled for October, at which time a decision should be made; therefore in order that the publications committee may fully consider all suggestions from the membership, it is desirable that same should be at hand at the earliest possible date and not later than Oct. 1. This communication, accompanied by a copy of the development committee's report and a recital of the action of the board thereon, is sent to you in advance of the current issue of the *Proceedings* so that you may have as much time as possible for consideration. Every one who is interested is earnestly urged to give these matters as much study as he believes them to merit and to send his comments thereon to the secretary as promptly as possible. If you do not express your views either in support of or in opposition to the development committee's report, neither the publications committee nor the board will know about them, and you may not like the action—or lack of it—which may result.

CALVERT TOWNLEY,
President.

ADDITIONAL COMMENTS ON REPORT OF DEVELOPMENT COMMITTEE

The following letters to the ELECTRICAL WORLD supplement those that have appeared in each of the five issues of August commenting upon the report of the development committee, which was given in full in the issue of Aug. 16, pages 374 to 376, as presented to the board of directors. Of the thirty-one letters published the writers of nine have not studied the changes and the writers of eighteen offer objections to popularization of the A. I. E. E. *Proceedings*, making it into an engineering magazine or conducting an advertising campaign. The majority of the letters favor the proposed changes in organization to promote strictly Institute affairs.

This week George Gibbs disapproves of the proposed changes in the publications, John F. Vaughan and Frank C. Sargent indorse Dr. Steinmetz' views and C. N. Poesl supports William Arthur's.

COMMENT ON PUBLICATION SECTION OF THE REPORT

Suggested Changes Are Not Favored—Advertising Disapproved—Example of A. S. C. E. Might Be Followed to Reduce Bulk

To the Editor of the ELECTRICAL WORLD:

SIR: I have yours of July 18 regarding the development committee report on A. I. E. E. activities. A reply has been delayed by my absence. I am not very close to the management of the Institute and therefore cannot comment in detail upon the changes proposed by the development committee. The report, as I read it, is suggestive and admirable in all respects except that part which deals with the publications of the Institute. This portion is, I think, open to adverse comment. I think it would be unfortunate, for instance, if its financial

condition should oblige the Institute to cut down or restrict in any way the present publication and circulation of the *Proceedings* and *Transactions*. These publications keep all members in touch with the activities of the Institute; the majority cannot attend meetings. I think it would be a mistake to change the present form, which is a convenient one for handling and binding; also, it would be a mistake to oblige members to return any portion of the monthly *Proceedings* to the Institute in order to have it bound. I disapprove of the scheme of making money by soliciting extensive advertising in the *Proceedings*. I would prefer to see all advertisements left out, as they add to the bulk of the publication, and I doubt if they are often consulted. Of course, it may be necessary to obtain some advertising revenue if the present plan of publication is maintained; this phase of the question I am not able to pass upon. I should like to see the Institute follow the example of the American Society of Civil Engineers in using thin paper for its publications. One's library increases very rapidly these days, and there are so many good things which should be preserved that saving unnecessary bulk is appreciated.

GEORGE GIBBS.

New York City.

MAINTAIN PRESENT HIGH STANDING OF INSTITUTE

Ideas of Dr. Steinmetz to Promote High Standard in Scientific and Technical Matters Favored—Decentralization of Activities Approved

To the Editor of the ELECTRICAL WORLD:

SIR: I have been hoping to get an opportunity to look over the matter of proposed changes in A. I. E. E. activities and let you have something of value, but so far have been unable to do so. In the light of the widely diverse views taken by such men as Dr. Steinmetz and others, I hardly feel qualified, without considerable thought, to give an opinion for publication. I do agree heartily, however, with Dr. Steinmetz in his fundamental idea of the purposes of maintaining the present high standing of the Institute in scientific and technical matters (ELECTRICAL WORLD, Aug. 2), which, I believe, might be modified by the handling of more commercial subjects by the local branches. I firmly believe in the advantages of still further decentralization of activities and the increase of general meetings of the districts.

Boston, Mass. JOHN F. VAUGHAN.

CHANGES PROPOSED BY THE DEVELOPMENT COMMITTEE

The Modifications and Suggestions Which Were Outlined by Dr. Steinmetz in the "Electrical World" Are Indorsed

To the Editor of the ELECTRICAL WORLD:

SIR: I have carefully read the articles in the Aug. 2 issue of the ELECTRICAL WORLD upon the proposed changes in the activities of the American Institute of Electrical Engineers. These articles were of much interest to me, particularly that of Dr. Charles P. Steinmetz on "Enhancing the Prestige of the Institute." In response to your inquiry, I am in complete accord with the position taken in this matter by Dr. Steinmetz.

Boston, Mass. FRANK C. SARGENT.

EMPHASIZES THE IMPORTANT FUNCTIONS OF THE A. I. E. E.

An Indorsement of the Three Suggestions by William Arthur in the Aug. 23 Issue of the "Electrical World"

To the Editor of the ELECTRICAL WORLD:

SIR: William Arthur's letter published in the Aug. 23 issue of the ELECTRICAL WORLD expresses exactly what I believe are the important functions of the A. I. E. E. His criticisms of the *Proceedings* are my criticisms also.

In my judgment this letter sets forth briefly the opinions of the majority of the Institute's membership.

Buffalo, N. Y. C. N. POESL.

COMMERCIAL JOURNALS AS A SOURCE OF A. I. E. E. REVENUE

Mr. Jakobsen Thinks that They Should Be Charged for Permission to Abstract Papers Prepared for Institute

To the Editor of the ELECTRICAL WORLD:

SIR: I agree practically with Dr. Steinmetz's suggestion that it would be unwise to make the *Proceedings* dependent upon advertising and that this would cheapen the Institute. On the other hand, I believe that if possible commercial journals should be prevented from abstracting papers read before the Institute free of charge and should be compelled to bear their share of the burden. I do not know whether such an arrangement can be made under the copyright laws.

Fresno, Cal. B. F. JAKOBSEN.

OUTPUT OF ONTARIO POWER COMPANY OF NIAGARA FALLS

Error in Statistics Changes Position of the Company from Second to Sixth in List of America's Largest Generating Systems

In the issue of the ELECTRICAL WORLD of March 9 (page 633) a table was published containing "data on output and load factor of largest generating systems in America." Reference to that table will show that the Ontario Power Company was credited with an output of 1,606,786,936 kw.-hr. This was an error as the Hydro-Electric Power Commission of Ontario, the present owner of the Ontario Power Company, reported on all the energy handled by the commission instead of that generated by the Ontario Power Company. This naturally gave the Ontario Power Company too high a place in the list.

The correct figures for the Ontario Power Company for 1918, as given to us by F. A. Gaby, chief engineer, are as follows:

Maximum twenty-minute peak	119,000 kw.
Date of peak	Oct. 19, 1918
Yearly output	963,845,200 kw.-hr.
Yearly load factor	92.4 per cent

This change places the Ontario Power Company sixth instead of second in the list of the great generating systems, two other Canadian companies, the Shawinigan Water & Power Company and the Montreal Light, Heat & Power Company, surpassing it in the total amount of output.

Method of Obtaining the Heating Effect of Varying Currents

To the Editor of ELECTRICAL WORLD:

SIR: The following method of obtaining the average heating effect of fluctuating alternating or direct current was described by the writer in the ELECTRICAL WORLD, page 18, July 1, 1905, in connection with an early form of the spark recorder. These recorders are not, as a rule, arranged for sparking directly from the instrument pointer to the recording paper, but have from 80 to 150 small wires per instrument for carrying the sparks from the pointer gap to a set of gaps arranged to direct the sparks into the recording paper along a straight line at right angles to the paper movement. This enables the readings of an instrument to be rectified, and also the scale divisions may be made uniform by properly spacing the spark wires.

In order to cause any instrument to record any power, root, multiple or sub-multiple of its readings, it simply becomes necessary to space the outer ends of the spark wires in the desired way.

For example: If one desires to record the squared values of the readings of a 10-amp. ammeter, the second spark scale should have a range of 100. Then the spark wires should connect the two scales as follows: 0 to 0, 4-16, 5-25, 9-81, 10-100, etc., so that the squared value of any current reading would be recorded. Given such a record, the average value of the squares may be obtained by an averaging planimeter.

F. W. SPRINGER,
University of Minnesota.
Minneapolis, Minn.

Temperature Rating of Motors for Continuous Service

To the Editor of ELECTRICAL WORLD:

SIR: It is but natural that in choosing a motor for a given application careful consideration should be given to the motor characteristics in order to obtain a machine best adapted to the particular service requirements. Knowing the service requirements, it will be easy to determine the type of motor—shunt or compound, squirrel-cage or slip-ring—to apply.

Continuous-service motors of the same characteristics are offered, showing a widely different temperature rise at the end of a heat run made at rated load.

In its efforts at standardization the Electric Power Club has established two temperature ratings, and in the 1918 Handbook, under reference No. 5303, the following definitions are given:

"(A) A rating giving a 40 deg. C. temperature rise guarantee under continuous operation with a two-hour 25 per cent overload guarantee at 55 deg. C., to be designated and known as the 40 deg. rating.

"(B) A rating giving a 50 deg. C. temperature rise guarantee under continuous operation without overload temperature guarantee, to be designated as the 50 deg. rating."

It is further specifically stated that "machines for 40 deg. rating are designed for all classes of service," while "machines for 50 deg. rating are designed for conditions in which the load requirements are accurately known."

The Electric Power Club definitions and explanations are clear, and there is no objection to the terms "40 deg.. rating" and "50 deg. rating." Furthermore, since in the opinion of a great many designing and operating engineers the 40 deg. motor is a longer-life motor and less of a trouble breeder than a 50 deg. motor, and also in view of the fact that a 50 deg. machine can be manufactured more cheaply, it is important to state what kind of motor is under consideration.

It has, however, been recently proposed to call the "50 deg. motor" a "continuous-rated motor," and some manufacturers are listing "constant-speed motors" and "continuous-rated constant-speed motors," the former being 40 deg. motors and the later 50 deg. motors. This practice diminishes the importance of the temperature rating, while the Electric Power Club practice accentuates the difference.

The basis for the common general-purpose-motor temperature rating is briefly as follows: Fibrous insulating materials, as cotton, silk, paper, enamel and similar materials (known as class A insulating materials) have commercially a sufficiently long life, provided that their ultimate temperature never exceeds 105 deg. C. Allowing for an ambient temperature of 40 deg. C. and a difference between hot spot and observable temperature of 15 deg. C., we arrive at a maximum allowable temperature rise of 50 deg. C.

It should be noted that 50 deg. C. temperature rise is a maximum limit of temperature beyond which class A insulation should not be used, because the life of such insulation is then considerably shortened.

Insulating materials are not affected by temperature only. The conditions under which motors operate, such as vibrations, moisture, ventilation, oil and dirt on the windings, materially affect the life of the insulation. It can be readily seen that if a motor showing on the test block a measurable temperature rise of 50 deg. C. has no factor of safety, under actual conditions of operation such a motor must have a negative factor of safety as far as the life of the insulation, and in consequence the life of the motor, is concerned.

It is well known that motors made from the same specifications, owing to variations in the materials used and also to the varying test arrangements, show a difference of from 5 deg. to 10 deg. C. in the temperature rise at the end of a temperature run.

Furthermore, motors manufactured in quantity are subjected to check tests only and a temperature heat run is made in only a few motors. Hence it is conceivable that a 50 deg. C. motor will, because of the variations above mentioned, be shipped from the factory with an actual temperature rise of 55 deg. to 60 deg. C. In order to insure the old 40 deg. standard motor against an excess temperature rise, they were actually adjusted to give on test an average temperature rise of 35 deg. C. and lower.

Undoubtedly 50 deg. motors are bought for no theoretical considerations, but because they are cheaper. The man who buys on price will rather overrate than underrate the machine he buys. Hence the writer's experience is that 50 deg. machines are trouble breeders.

Practically every manufacturer can point to machines which have been in service for twenty years with no other replacements than a set of carbons or some other small item. Invariably upon investigation it has been found that such machines operated at temperatures well below the ones given by the A. I. E. E. as the limit for good practice.

Owing to the lack of a factor of safety in the temperature at which the insulating materials are worked in 50 deg. motors, an intimate knowledge of the conditions under which a motor will have to operate during its whole life is imperative.

In view of the fact that even the most careful investigation seldom correctly reveals present and future requirements, the writer is opposed to the suggestion of calling a 50 deg. motor a "continuous-rated" motor, thus diminishing rather than accentuating the vital effect of temperature rating on the life of the motor. Buyers of electric motors will do well to consider upkeep and repairs besides first investment. The slight difference in cost between a 40 deg. and a 50 deg. motor will soon be offset when considering the more rapid depreciation of the cheaper motor. By adhering to the Electric Power Club's terminology the interests of the public are better safeguarded than by adopting the term "continuous-rated" motor for a 50 deg. machine.

It is possible that competition will force all electric motor manufacturers to adopt the 50 deg. machine as standard, but in such a case it will devolve upon the user of electric motors to determine by repeated test that his motors are operating within safe temperature limits. To obviate such a situation, evidently unsatisfactory to the motor user, the writer would recommend that 40 deg. machines be specificially demanded in all calls for bids.

JUSTIN LEBOVICI.
Designing Engineer Triumph Electric Company, Cincinnati, Ohio.

Readers' Views and Comments

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

TRANSFORMERS HAULED ON LOW-HUNG TRAILERS

Platform Elevated Only 30 In. from the Ground Without Springs—Trailers Also Used for Transporting Line Poles

The advantages of motor transportation for central service stations are many and the methods of transportation are steadily increasing. One large company in the Middle West has low-hung trailers for hauling heavy equipment such as transformers and line poles. These trailers are extremely economical and convenient. As the platform is elevated only 30 in. (80 cm.) from the ground without springs, a double advantage is gained in that the center of gravity is low and that ease of loading and unloading is promoted.

The low center of gravity is essential when high machines are being handled. Many transformers are 12 ft. (3.5 m.) high, weighing up to 8½ tons, and with a low-hung vehicle it is an easy matter to obtain sufficient clearance.

The conveyance is also economical for the delivery of cable on reels, especially when the haul is long, because a 5-ton truck with trailer can transport six reels, amounting to about 13 tons. Another use to which a central station could put the trailer is the transportation of toolhouses on large construction jobs. These houses with all necessary tools could be moved to the site of the work and would insure a prompt delivery where a long haul was necessary. When transporting poles it is necessary to use two such trailers and with this arrangement twenty-eight 45-ft. (14-m.) poles have been handled These loads average nearly 10 tons, which is approximately the capacity of the solid-rubber tires.

EMERGENCY REPAIR FOR TRANSMISSION LINES

Material Suitable to Make Any Common Repair Is Carried in Special Houses at Short Distances Along the Line

Stocks of transmission-line material for emergency use are carried at many convenient points along the lines of the Wheeling (W. Va.) Electric Company. It is a rule of the company that these stocks must not be more than 10 miles (16 km.) apart, and if substation buildings are not available to house the material at points where it appears desirable to have the emergency stocks, a special combination storehouse and telephone booth is erected for the purpose. This plan is followed on some 200 miles (320 km.) of line. A list of the material which is required to be kept at each emergency repair station is given in the accompanying table.

The combination storehouse and telephone booth, which measures about 10 ft. by 8 ft. by 9 ft. (3 m. by 2.5 m. by 2.8 m.) was designed by the Electric Bond & Share Company. The booths are supported on 8-in. (20-cm.) piles, are inclosed with 1-in. by 8-in. (2.5-cm. by 20-cm.) siding with weather strips, and covered with No. 28 gage corrugated-iron roofing. Frank Howard, general superintendent of the Wheeling Electric Company, has stated that this type of building fills the requirements in an entirely adequate manner.

PERMANENT EQUIPMENT FOR EMERGENCY STATIONS

Six strings insulators, 10 disks each.
Two assemblies of tension hardware.
Two assemblies of semi-tension hardware.
Six assemblies of suspension hardware.
Fourteen splicing sleeves for conductor.
Six splicing sleeves for ground wire.
Twenty-four protecting sleeves.
2500 ft. copper conductor on horses.
500 ft. ⅜ S. M. ground wire.
One pair bolt cutters.
Two Wescott wrenches, six drifting wrenches.
Two 4-in. snatch blocks.
200 ft. 1-in. rope.
Six rope slings, three pairs triple blocks.
Two come-alongs for conductor.
Two come-alongs for ground wire.
Two assembling ropes with come-alongs attached.
Three ground pins, 2 in. by 4 ft.
18 ft. ½-in. chain with ring and hook.
Double jack (double hand hammer), two handles for same.
One axe, two picks, two shovels.
One box tower bolts, two lanterns.
One can of oil, ten lamp wicks.
One ball peen hammer, one pair pliers.
Three boatswains' chairs.
One set grounding wires.
Three sets ⅝-in. hand lines with single sheave pulleys.

TESTING INSULATORS BEFORE ERECTION REDUCES FAILURES

Should Not Be Overstressed, However, as Excessive Strains Thus Developed May Weaken Good Units

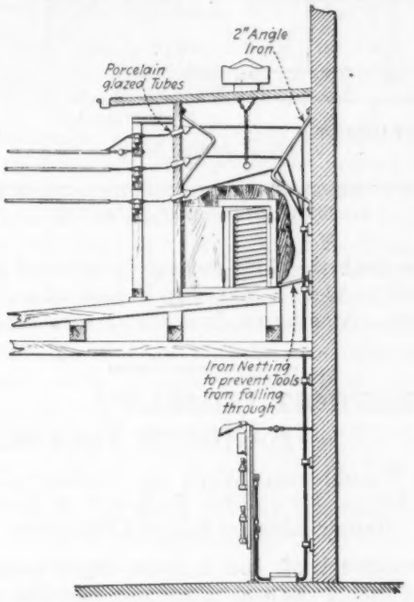
A discussion of insulator troubles at a recent state convention brought out the opinion from operating men that it is good practice to test all 33,000-volt insulators before they are put on the pole lines. Some favored having this done at the factory, and others thought the testing should be done in the field. One manager said his company had tested in the field all insulators that went with a 30-mile (42-km.), 33,000-volt line and had eliminated 2 per cent of the insulators, and therefore only two insulators had failed on the line during its eighteen months of operation. He advocated giving insulators the regular factory test just before they were put up.

The representative of a large insulator manufacturer taking part in the discussion cautioned central-station men against overstressing the insulators. He suggested that it is generally best to let the insulator manufacturer decide what are the logical limits of testing. In the absence of instructions from the manufacturer he expressed the belief that a safe way to test would be to increase the voltage to approximately the spill-over potential and then drop back 10 per cent.

POWER-HOUSE WIRE TOWER ALLOWS OUTLET FOR FEEDERS

Built on Roof of Engine Room Over Switchboard, It Provides a Convenient and Flexible Method of Directing Lines to Destinations

In a plant where a larger switchboard and another generator were to be installed it was found that no outlet was reserved for the many feeders necessary. The old feeders had been carried on cleats along the ceiling



WIRES ARE BROUGHT FROM BACK OF SWITCHBOARD TO THE TOWER, WHERE THEY ARE DIRECTED TO THEIR DESTINATIONS

and through the front wall where only a small number could be accommodated. In order to take care of the new feeders the roof beams over the switchboard were reinforced and a space 2 ft. (60 cm.) wide by 15 ft. (4.5 m.) long was removed. A wire tower was built upon the roof adjoining the main building with two adjustable 20-in. (50-cm.) ventilators operated by a chain erected on the roof. Racks made of 2-in. (5-cm.) angle iron were bolted to the back and front walls inside, over which were carried the feeders from the distributing panels below. Only slow-burning insulated wire was used from the boards to the tower, where it is connected to the outgoing weatherproof-covered wire.

Lines are directed from the tower to their ultimate locations and may be tapped to one another in the tower where copper capacity allows, to obviate wiring completely to the switchboards.

A heavy wooden door to the tower which is lined with sheet iron is kept locked excepting in the warm weather, when an inside lattice door only is used to afford ventilation. This latter helps to ventilate the engine room. To hold the feeders running through the front wall of the tower glazed porcelain tubes are used, and the feeders are carried 2 ft. (60 cm.) further to a heavy wooden rack having pins for the lighter lines and strain insulators for the heavy lines. This rack is held firmly in place by a length of track rail fastened to the main building wall with 1-in. (2.5-cm.) iron rods, the rail having its bearing against the rack where the greatest line strain is exerted.

From the switchboards to the tower all lines are evenly spaced 2½ in. (6.2 cm.) apart and are cleated at measured intervals on the wall. As the engine-room roof is quite spacious, the size of the tower can be increased to accommodate more lines from other new boards. An iron-wire netting fastened over a pipe framework is placed at an angle over the floor opening to prevent a misstep or any tools being dropped onto the boards below. This netting and frame are on hinges and can be tipped back out of the way of workers when desired.

The roof coping has a deep gutter built in with a leader pipe at one end, and it overhangs far enough to prevent icicles from reaching the pins and strain insulators.

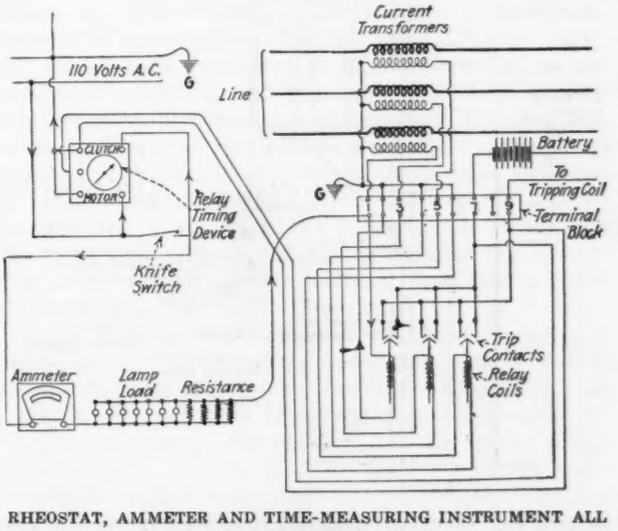
H. S. RICH.

East Berlin, Conn.

TESTING AND SETTING TIME-LIMIT RELAYS

Portable Ammeter and Variable Resistance Are Used for Testing—Time of Operation Measured by Timing Device

In testing and setting relays for operation at a given time and for a given amount of current the Edison Electric Illuminating Company of Boston has devised apparatus which consists of a variable resistance, an alternating-current ammeter, a source of low-voltage alternating current and some device for measuring a very small amount of time. The majority of time relays are set to operate at from one-quarter of a second to five seconds or more. The instruments are connected as shown in the diagram with the ammeter, relay coil and variable resistance for loads in series across the supply source of 110 volts alternating current. The knife switch is used to open and close this circuit at will, and it also controls the circuit through the electromagnetic clutch of the relay timing device. When this switch is thrown to close the circuit the current flows in two directions, one through the ammeter, load coil and relay coil and the other through the magnetic clutch, thus



RHEOSTAT, AMMETER AND TIME-MEASURING INSTRUMENT ALL THAT IS NEEDED FOR TESTING

starting the timing device and the relay in operation at exactly the same time. The relay is then held in its normal operating position until the correct amount of current is indicated at the ammeter by the variation in the resistance. The knife switch is then opened.

The pointer of the timing device is set at zero, and the switch is again thrown in a closed position, making

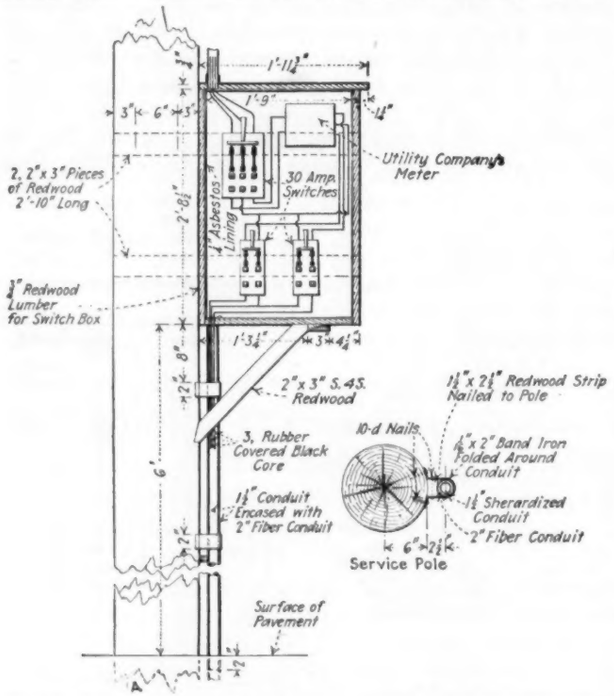
the clutch of the timing device alive and causing the pointer to revolve, and also causing the relay to start operating. When the relay finishes operation and closes the trip contacts the timing clutch automatically becomes shunted, causing the pointer to stop. This shows the time of the operation of the relay in seconds.

The timing apparatus consists of a small synchronous motor, made by the Warren Clock Company, having a reduction worm gear connected to the motor shaft The whole device is inclosed in a small box with the necessary terminals conveniently mounted. The clock is electrically controlled by means of the same switch that energizes the relay coil under test.

WOODEN SERVICE BOX ON LIGHTING STANDARD

Controls Day and Night Lights for Twenty-one Concrete Standards—Branch Outlet Box at Bottom of Post

For lighting a sea wall at Long Beach, Cal., twenty-one concrete lighting standards of the three-lamp type were used in order to give an effective lighting system. Energy is supplied from a three-wire circuit to a service box placed 6 ft. (1.8 m.) from the base and upon the pole of the standard attached as shown. The meter is in this box and connected to the line through a three-pole, 30-amp. switch. On the other side of the meter two double-pole, 30-amp. switches are arranged so that the three wires make two circuits, one circuit being used for all-night service and controlling the top

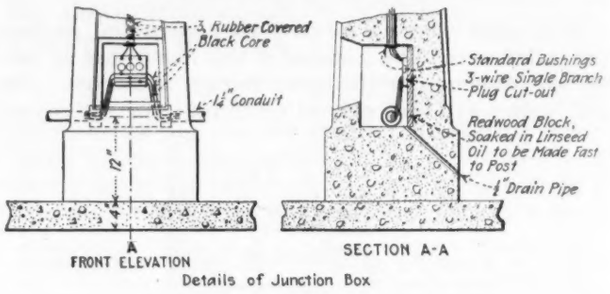

Utility Company's Meter
30 Amp. Switches
2, 2"x 3" Pieces of Redwood 2'-10" Long
¼" Asbestos Lining
¾" Redwood Lumber for Switch Box
2"x 3" S.4S. Redwood
1½"x 2½" Redwood Strip Nailed to Pole
10-d Nails
3, Rubber Covered Black Core
½"x 2" Band Iron Folded Around Conduit
1½" Conduit Encased with 2" Fiber Conduit
1½" Sherardized Conduit
2" Fiber Conduit
Service Pole
Surface of Pavement

SERVICE BOX LINED WITH ASBESTOS AND PROTECTED ON THE ROOF BY SHEET IRON

lights only. The other switch controls the other two lamps.

The box is made of ¾-in. (18-mm.) redwood lumber, lined with ¼-in. (6-mm.) asbestos and covered on the roof with 20-gage galvanized iron. Instead of being attached directly to the pole, the 1½-in. (37-mm.) sherardized conduit containing the circuits and incased in a 2-in. (5-cm.) conduit is held away from the pole by means of a 1½-in. by 2½-in. (3.7-cm. by 6.2-cm.) redwood strip.

At the bottom of the poles there is a three-wire disconnecting cut-out for controlling each standard sep-



MOUNTING OF THREE-WIRE DISCONNECTING CUT-OUT FOR CONTROLLING STANDARDS SEPARATELY

arately as desired. This cut-out is fastened to a block of redwood previously soaked in linseed oil and attached to the post. A cast-iron door allows easy access to the cut-out.

HOW DETROIT COMPANY HANDLES TROUBLEMEN

District Troublemen Work as Individuals, While Three Crews of Two Men Each Act as Emergency Repair Men on Major Difficulties

The personnel of the trouble department of the Detroit (Mich.) Edison Company consists of seven dispatchers, nineteen men "shooting trouble," three of whom work on the street lighting, and six emergency men who take care of trouble on the power lines. All of these men work on eight-hour shifts arranged so that there are two dispatchers and two emergency men on duty all the time and so that from 7 o'clock in the morning until 12 midnight the "trouble shooters" take their respective shifts. Each man has his own territory in the city and under normal conditions works in that district only, but he may be sent anywhere at the discretion of the dispatcher. This redirection of the men outside of their own territories happens in times of storms which may affect one part of the system more than another. All of the troublemen are linemen. In addition to these men there are eight other outside men and five men in the shop on appliance repairs. They cannot be properly called troublemen, but they nevertheless have to do with maintenance of service.

The emergency men as distinct from the troublemen are those who in ordinary cases take care of trouble on the power lines. The emergency men travel in pairs while each troubleman works by himself. The automobile of the emergency crew is equipped with material and apparatus for making temporary repairs on the 4600-volt and primary lines. These men also respond to pulmotor calls.

The routine of a trouble call is as follows: The dispatcher receives the call over the telephone, makes a note of the time it was received and places it in the box numbered for the man in whose district the trouble lies. Each man keeps in constant touch with the dispatcher by telephone, and when that particular man calls he is given the call and the time is again noted. On the completion of the job the troubleman again calls the dispatcher and reports service restored.

INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

SHEET BAKELITE USEFUL FOR SMALL SWITCHBOARDS

Its Chief Advantages Grow Out of the Fact that It Requires a Small Amount of Labor to Prepare It for Installation

Small boards for mounting relays, meters, bells, etc., can often be made of bakelite-micarta instead of slate. The advantages of micarta over slate are: It can be sawed, milled, drilled and tapped as easily as hard wood; it does not chip, split or crack when machining; it will stand repeated shock and vibration; it is lighter and thinner for the same mechanical strength.

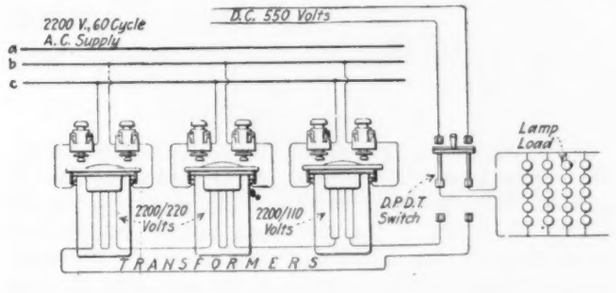
The tougher grades of tar bakelite-micarta from ¼-in. (6-mm.) to ½-in. (13-mm.) thick are especially suitable for such work. Boards for time-clock equipment, wireless equipment, fire alarms, testing panels, signal systems, etc., can be constructed more cheaply of micarta than of slate or fiber, because the equipment is light and connections are numerous. In one actual installation a 36-in. by 36-in. by ⅜-in. (91-cm. by 91-cm. by 0.9-cm.) micarta switchboard for a time-clock system cost about 40 per cent as much as a 1-in. (2.5-cm.) thick slate board. The chief saving was in drilling labor.

Chicago, Ill. E. E. GEORGE

GETTING SERIES LIGHTING FROM D.-C. OR A.-C. SUPPLY

Arrangement by Which a 550-Volt Trolley Lighting Circuit Can Be Fed from a 2200-Volt A.-C. Supply in Emergencies

There are many small villages, some factories and power stations and a large number of interurban stations that are lighted from the 550-volt direct-current trolley circuits of a nearby electric railway. Frequently



SERIES LIGHTING AT 550 VOLTS FROM AN ALTERNATING-CURRENT SUPPLY

no cars are operated on these railways between the hours of 1:30 a. m. and 5 a. m. During this time the railway substations are usually shut down and no electric service is supplied to the trolley circuit. At such times an auxiliary source of energy must be used.

To provide such service without installing a separate set of lamps requires a supply of alternating current at 550 volts, because lamps operated from trolley systems are ordinarily connected five in series across the two legs of the line. A single transformer to effect a 2200-volt to 550-volt potential reduction is not a standard unit, but the transformation can be made by using three standard transformers. Two of these may be rated at 1 kw., 2200/110 volts, and one at 2 kw., 2200/110 volts. Connections for these units are shown in the accompanying sketch. By such an arrangement it is possible to get either alternating-current or direct-current lighting supply by throwing the double-pole, double-throw switch to either the down or the up position.

ELLIS G. KING.

Indianapolis, Ind.

HOT BEARINGS COOLED WITHOUT STOPPING MOTOR

Sand and Dirt Successfully Removed with Gasoline and Chipped Soap Plus Sulphur for Bronze and Graphite for Babbitt Bearings

In a Milwaukee (Wis.) steel foundry engaged in rush war work, where trouble was experienced from motor bearings becoming heated owing to sand getting in them, emergency methods were devised that successfully cleaned out the bearing while the motor was in operation. Heating of the bearings was usually accompanied by churning of the oil rings, which often makes an appreciable noise and causes the bearings to throw oil. When these conditions were noticed additional oil was poured into the bearings. If the oil rings did not then become quiet or at least show some improvement within a few seconds, the bottom oil plug was removed and gasoline poured into the bearings as the old oil ran out. This was often sufficient to wash out the dirt or grit which might have gathered in the bearings, and when it had apparently done so the gasoline was replaced by a heavy oil. When the heavy oil had drained out of the bearing the bottom plug was replaced and the bearing filled with a high-speed oil.

If the bearing still remained hot, small pieces of a heavy laundry soap were chipped off with a pocket knife and dropped into the bearings. When the soap melts it will run into the bearing housing, into the oil-ring openings of the bearing, and fill up the scores on the shaft. In the case of bronze bearings some powdered sulphur was added and with babbitt linings graphite was put into the bearings. Oil was then poured into the bearings until it ran out of the overflow plug. When the oil ring stopped pumping the bottom plug was removed again, the dirty oil drained off, the bearing washed with gasoline, the bottom plug replaced and the bearing refilled with new oil. Into this new oil there is mixed about a teaspoonful of sulphur for bronze bearings or a similar amount of graphite for babbitt bearings. Bearings will need close

watching after this treatment has been completed, but they will usually cool down in a short time.

This process has cooled many hot bearings without shutting down the motor and has been applied successfully to the removal of sand from the bearings of 50-hp., 3500-r.p.m. induction motors. Some of the bearings which were so treated more than a year ago are still giving good service. As in all such foundries sand and dirt are omnipresent; therefore all the material required for cooling hot bearings is kept in locked cabinets near important groups of motors. These locked cabinets contain cans of sulphur, gasoline and graphite, a bar of "American Family" soap and a bottle containing a mixture of "Arctic" engine oil (a high-speed oil) and red engine oil (a heavier oil) in about equal proportions. These "bearing medicine chests" have paid for themselves many times over. They have made it possible to keep motors in operation when great losses would have resulted if the motors had been shut down.

B. F. RUREY, Chief Electrician,
George H. Smith Steel Company, Milwaukee, Wis.

CIRCUITS TESTED WITH TELEPHONE RECEIVERS

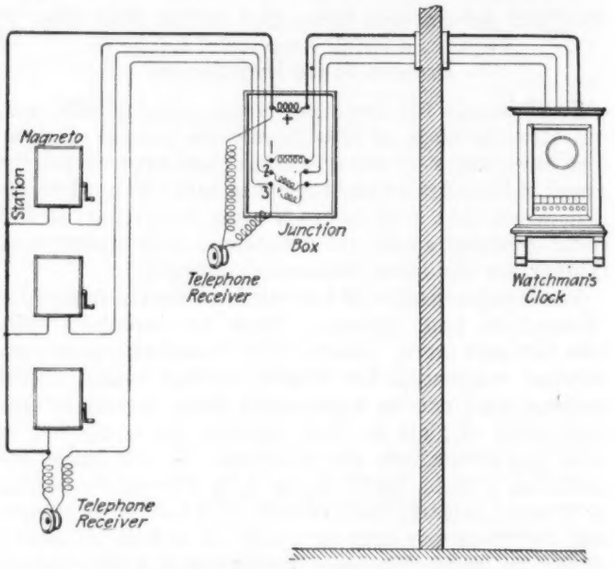
Receivers Are Connected to Terminals of Watchman's Circuit and a Click Is Heard When Lines Are Located

In a factory where the magneto system for indicating the watchman's movements is installed many bad circuits were reported every few days, and it was difficult to locate the trouble in short time on account of the long lines and the type of installation. The circuit wires were attached to posts by means of wood molding and the latter in many places had been damaged by passing trucks. On the ceiling they were held by bent nails, tin and tape straps. Sometimes they went through walls without insulation. Between the floor beams the slender No. 18 B. & S. gage wires often sagged for 10 ft. (3 m.) or more where ladders encountered them.

When testing for opens and shorts the worst feature was the lack of identification as black wire was used in some rooms for the common return and then suddenly changed to another color. The magneto circuits were run in blue and red, so to make a quick test. To make matters more difficult the stations were frequently shifted about as the watchman's route was often changed. It was urgent that this situation should be bettered so the system was rehabilitated as follows:

It being inconvenient to make the changes of lines in the master clock as it is in the main office, a junction box was built and installed in the next room which is part of the shop proper and where the tester would not be disturbed. The terminals of each line were double-numbered and flexible lamp cord was used as jumpers between so that any desired connection could be obtained. This bettered conditions considerably. Then by testing with two dry cells at any distant magneto terminals a bell could be rung at the junction box to identify the circuits without interfering with the office clock.

But such testing was not found adequate because too much delay was caused, and the use of two telephone receivers was resorted to. One is connected at the magneto terminals and the other in the junction box with one leg of the common return, and a long flexible lead is used to explore for the proper circuit. When this is found a "click" is heard and conversation can be carried on by using each receiver as a transmittor. By this means also tests can be repeated, numbers asked for and location given, all of which was not possible with a bell. Before leaving any station the common return is marked by a tag, after being identified by testing from a supposed line to the nearest sprinkler pipe for a circuit. The common return has been carried all through the plant with a bright red wire and tapped in at all stations. Use of the watchcase tele-



TWO TELEPHONE RECEIVERS ARE FOUND PREFERABLE TO BELL FOR TESTING CIRCUITS

phone receivers was found to be very practicable and trustworthy, and conversation may be carried on through two wires or one wire and a ground pipe system. Often one leg of a circuit was found open, but the other leg would allow a test when aided by a water pipe.

H. S. RICH.
East Berlin, Conn.

RELIABLE LIGHTING FOR POWER INSTALLATIONS

Connections Ahead of Power Circuit Breaker Make Lighting Service Independent of Local Power Interruptions

Industrial plants which buy light and power service through one meter usually desire to keep each class of service independent of interruptions occurring on the other. Troubles in the plant can usually be localized by connecting the lighting circuit ahead of the main circuit breaker which is used in the majority of cases to protect the power system. This method of connection keeps the lighting system in operation during local power interruptions when illumination is badly needed. If trouble should develop on the lighting circuit, test lamps may be connected to the power lines to supply energy for lighting until the trouble has been corrected.

Primary light and power consumers may take their lighting service off the secondary side of the power transformers, but where the continuity of the lighting service is important separate high-tension lighting transformers are usually installed. A primary light-

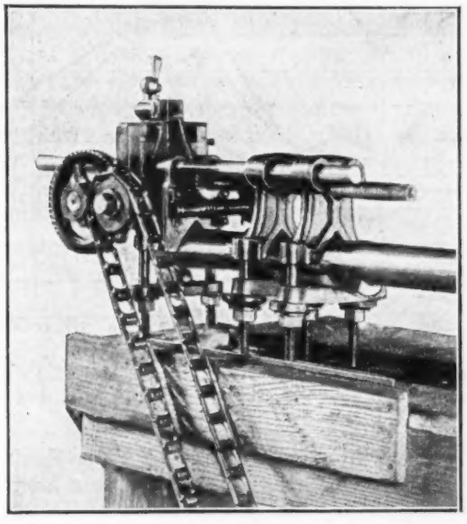
ing transformer adds somewhat to the expense of the installation, but a few cases of trouble on the power circuit will usually show that the extra expense was a good investment. As another safeguard connections are frequently made to permit the lighting load to be switched from the primary lighting transformers to a balance coil on the secondary side of the power transformers in case of trouble. Another plan is to install the primary lighting transformers in duplicate and provide a switch on the secondary side to throw the lighting load from one to the other. In large installations primary oil switches are often installed to protect the lighting transformers, but in most instances the lighting transformers are connected through high-tension fuses and disconnecting switches ahead of the main oil switch.

PORTABLE HAND KEYSEATER DRIVEN ELECTRICALLY

Operation by Electric Motor Through Two Belts and a Chain Drive Increases Production Greatly—Electric Installation Costs $80

A machine shop having frequent occasion to cut keyways in shafts used in the construction of special machinery has adapted a Burr portable keyseating machine to efficient use with electric motor drive. The keyseater was designed for hand operation, but this is a laborious process where much work has to be done, and the use of electric power permits about three times the former output.

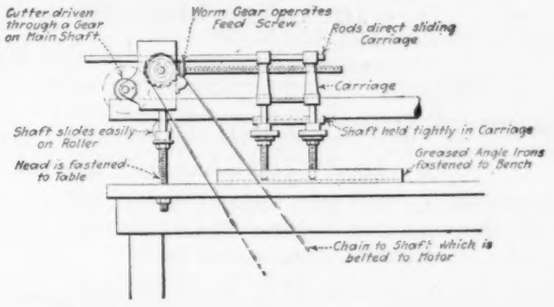
As indicated, the motor, a 1-hp. single-phase Wagner, is mounted on a bracketed platform attached to



HAND TYPE OF KEYSEATING DEVICE REARRANGED FOR OPERATION BY A MOTOR

the wall. It is belt-connected to a countershaft below, whence there is a second speed reduction to a second countershaft which drives the keyseater through a No. 52 detachable chain connecting with a sprocket on the crank shaft of the machine. The carriage of the keyseater, which feeds the shaft to the miller, rests in a channel consisting of two parallel sections of 1-in. by 1-in. (2.5-cm. by 2.5-cm.) angle irons secured to the worktable by screws with countersunk heads, while the head of the keyseater is secured to the table itself. With this outfit a ½-in. by ¼-in. (13-mm. by 6-mm.) keyway 12 in. (30 cm.) long can be cut in about twenty minutes.

The cost of the motor, shafting and wiring was about $80. No starting box was required, and the motor is


Cutter driven through a Gear on Main Shaft
Worm Gear operates Feed Screw
Rods direct sliding Carriage
Carriage
Shaft slides easily on Roller
Shaft held tightly in Carriage
Head is fastened to Table
Greased Angle Irons fastened to Bench
Chain to Shaft which is belted to Motor

CUTTER DRIVE AND METHOD OF MOVING SHAFT HORIZONTALLY

started and stopped by a cord run to the switch from the machine. The shafting occupies no space otherwise useful, and the chain drive to the keyseater afforded the only practicable means of operation, there being no room on the pulley on the keyseater. Shafts up to $2\frac{3}{16}$ in. (5.6 cm.) diameter and 53 in. (73 cm.) long are slotted by this equipment.

A.-C. SPEED-CONTROLLING AND STARTING DEVICES

Characteristics and Relative Advantages of the Better Known Methods of Starting and Controlling the Speed of Alternating-Current Motors

Auto-transformers and resistors are about the only familiar pieces of apparatus for starting and controlling the speed of alternating-current motors, but there are other devices which deserve consideration.

Auto-transformers are most extensively used for starting induction motors, but resistance starters are coming into use. Regarding these two, the power component of the line disturbance is larger for the resistance starter, but it is largely if not entirely offset by the extra lagging current required to magnetize the auto-transformer. The latter does have the advantage over the resistor as regards power consumption; however, the time of starting is so short that the wasted energy is not of much moment. The resistance starter is clearly superior to the auto starter so far as adjustment of voltage is concerned, and it can be manufactured at a lower cost. For large motors the advantages lie on the side of the auto-starter.

Hysteresis starting devices give good speed regulation and good torque at low speed and in starting but somewhat impair the power factor. The same can be said of eddy-current devices, double and triple squirrel-cage windings and deep-bar rotors.

Resistance in the secondary of polyphase induction motors is used extensively for adjusting their speed, but gives a speed varying with the load. Pyro-electric resistance used similarly gives good speed regulation, but such conductors tend toward instability.

Capacity in the secondary gives good speed regulation but rather poor power factor. This method usually requires an uneconomically large amount of capacity.

Commutators on alternating-current machines permit good speed regulation and power-factor control but have the disadvantage that it is hard to eliminate sparking. Concatenation has the disadvantage of complication.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods for Increasing the Use of Electric Light, Power and Heat

WAYS OF MERCHANDISING ELECTRICAL APPLIANCES

Suggestions as to How Retail Stores of Central Stations Can Increase Their Sales and Their Percentage of Profit

Give premiums with sales, distribute profit-sharing coupons, and sell on deferred payments. These are some of the important methods of stimulating merchandise sales suggested in an informal paper which E. A. Edkins, general manager of electric shops for the Commonwealth Edison Company, read before the sales managers' convention at Association Island, N. Y., Aug. 4, 5 and 6. Mr. Edkins suggested these methods because they are among the most profitable which the Chicago company has tried in the several years it has been conducting intensive merchandising work.

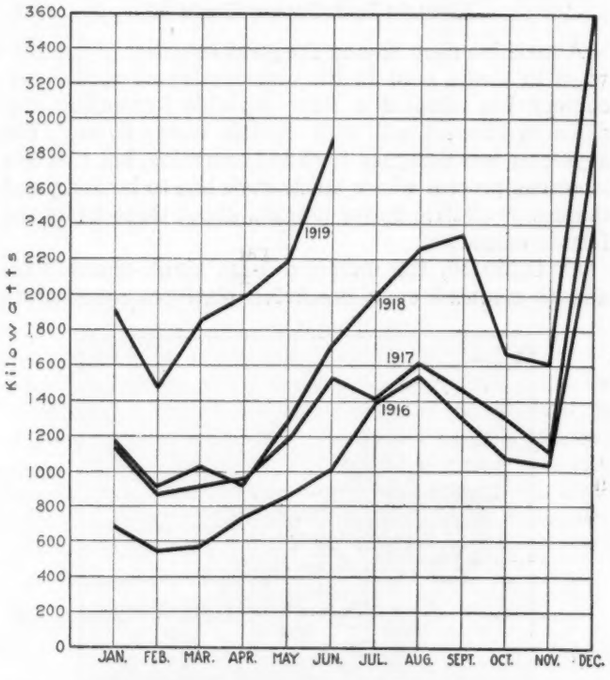
Concerning these suggestions Mr. Edkins said in part: "By the use of the premium plan we have sold several thousand more washing machines and vacuum cleaners than we could have sold otherwise. Moreover, our customers like the premium plan. I believe that premiums will always be an effective means of increasing sales. I have tested the coupon plan in our electric shops for three years. It is a winner. It increases attendance, multiplies good will and builds up all classes of sales. I believe it has been an important factor in the large increase in our sales in the last three years.

"The Chicago Association of Commerce recently compiled the following data giving percentages of sales in 1918 in Chicago, covering only a few of the items sold on the deferred-payment basis: Pianos, 75; talking machines, 90; refrigerators over $50 each, 75; electric washers, 80. The following figures show the percentage in our electric shops on sales under the different terms based on monthly figures for a period of five years, during which time our gross sales of electrical appliances (not including incandescent lamps) have increased from $250,000 to $3,000,000:

	Percentage		
	Deferred Payment	Charge	Cash
1915	35	40	25
1916	34	30	36
1917	37	27	36
1918–1919	47	19	34

"The deferred-payment privilege is only another form of service. Do our customers appreciate this service? Look at the above figures and you will find the answer."

Mr. Edkins also discussed certain appliances and methods as specific opportunities for sales promotion. Among the appliances which he mentioned as deserving of especial attention were ironing machines, sewing machines, washing machines, suction sweepers, portable lamps, silk shades, other fabric shades, electrical household wiring conveniences, style merchandise, electric ranges and electrically operated talking machines. In his discussion of style merchandise Mr. Edkins said: "In the earlier times the fireplace was the focal center of domestic life and the rallying point of the family, particularly during the evening hours. With the gradual disappearance of the fireplace in modern homes and particularly in apartments, the library-table reading lamp has supplanted the open fireplace as the center of the family circle. For this reason and because of the unusual opportunities which it presents for color effects, this lamp should strike a dominant note in the decorative design and color sceme of the room. Its very function and quality make it the most prominent article of furniture, and it should therefore be one of the most beautiful things in the room." Mr. Edkins then recalled a letter which he had written to a lamp manufacturer suggesting that he could do a service to art as well as to himself by encouraging art schools to develop more original and attractive lamp designs. A number of designs secured from a competitive collection from art schools was exhibited. This and other developments of style merchandising Mr. Edkins urged the sales managers to support.



TOTAL RATED KILOWATTS OF CAPACITY BY MONTHS OF APPLIANCES SOLD BY COMMONWEALTH EDISON COMPANY

Of predictions concerning the future in electrical merchandising there were few in the paper, but those few were important. The belief was expressed that the more progressive central stations will continue in the electrical merchandising business for some years to come and that moth-eaten traditions of public corporation "dignity" and ultra-conservatism would have to give

way for red-blooded merchandising methods such as other local retail stores employ. The outlook for 1920 was characterized as "big," and the opinion was ventured that while more price increases might be expected during the next few months, the market had about reached the top.

IT PAYS WELL TO TRAIN METERMEN INTENSIVELY

Method of Education Employed by Dayton Power & Light Company Leads to Savings Through Detection of Energy Thefts

BY CHARLES P. GARMAN

In the last year or more, when good help has been scarce, experience has taught many central stations that a good meter reader is a valuable asset to a public utility. Most meter readers in the past were young men or boys that knew nothing of the organization of the company for which they worked or of the product which they sold. Their duty was to read meters, making as few mistakes as possible, and read as many as possible in a given time. This system, while it answered the purpose, was not entirely satisfactory, and after considering that the customer's installation is very seldom visited by any one other than a meter reader or an occasional inspector or tester, it is easily understood that a person who is so inclined can take advantage of the company.

Then again, the meter reader represents the company to a large percentage of its customers and for this reason should be a man who can do so creditably. With these things in mind, the Dayton (Ohio) Power & Light Company carefully selected several young married men who it was thought were adapted to this kind of work and gave them a short course in intensive training. This course consisted first of thoroughly teaching them to read meters. Next they were taught the different makes and types of meters in use by the company, their construction, etc. This was accomplished by having them spend a week in the repair department, where they reassembled meters of different makes. They were then transferred to the outside and placed with a competent meter installer and were thus familiarized with different types of meter installations, such as alternating-current and direct-current, two-wire and three-wire.

After another week had passed they were transferred to the inspection department and sent out with an experienced man to handle customers' complaints. The object in this was not to teach them to handle complaints, but to teach them discretion in dealing with customers.

In the three weeks' course they were taught by lecture and through the meter reader's instruction book how to check dial constants on the meters against dial constants on the route sheet, to whom to report wires or services which were too low, poles broken off, trouble calls, complaints, etc.

Several weeks at meter reading, with the additional information picked up in this time, placed them in a position to be fairly reliable inspectors as well as meter readers. The company then began to notice an appreciable increase in the number of detected cases of theft of energy. Later it was thought advisable, in order to stimulate the men's efforts along detective lines, to offer them a bonus of $5 for every case of theft they found. This offer, in connection with their previous training, has accomplished wonders.

At present all meter readers are on a bonus system. They are paid a bonus for speedy reading, provided that they read 92 per cent of the meters during the month. They are given a bonus for detection of theft of electricity. They are given a bonus for finding a wrong dial constant. On the other hand, they are penalized for every mistake they make in meter reading.

The results produced by this experiment show that it pays to spend several weeks or a month training men before they are put on this particular kind of work. They themselves are more satisfied also, since they feel that they know something of value and are not merely automatons.

MILK CERTAINLY COSTS A LOT MORE, BUT WHAT'S THE USE OF KICKING
MILK BILL
$5. USED TO LAST MOST A WEEK, BUT I SUPPOSE EVERTHING COSTS MORE TO PRODUCE NOW
$12. MADAM
I SUPPOSE THEY'RE WORTH IT - LEATHER IS SO HIGH
I DONT SUPPOSE CANDY EVER WILL BE MUCH LOWER AGAIN
ONE DOLLAR, PLEASE
THREE DOLLARS
AND TO THINK THESE USED TO COST ONLY $1.50 - SUPPOSE THEY HAD TO RAISE THE PRICE
GLOVES $3.00
THE IDEA! THE LIGHTING COMPANY WANTS TO RAISE IT'S RATES
IT'S ROBBERY!
DAILY NEWS

—From the Society for Electrical Development, Inc.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

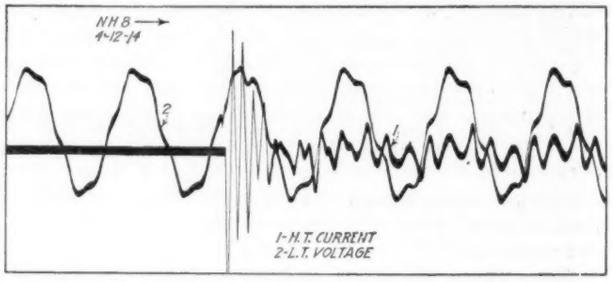
The Forced Oscillations of Coupled Alernators.—A. BLONDEL.—The author utilizes his theory of the two reactions for the determination of the working conditions of alternators coupled in parallel with their speeds oscillating about a mean value. By the aid of analytical developments of formulas already established by the author in preceding articles and by the introduction of a special torque, called by him "complex torque" because its expression is the sum of a real term representing the synchronizing torque and of an imaginary term containing the damping torque, the author examines the case of compounded alternators and of ordinary alternators possessing two damping circuits one of which is constituted by the exciting circuit. For the latter case the author gives the circle diagram and discusses the conditions which allow of satisfactory working of the coupled alternators. In some cases it is advantageous to increase the resistance of the exciting current, while in other cases it is its inductance that must be increased. In the second article the question whether the oscillations tend to increase in amplitude is considered at length from a mathematical standpoint.—*Science Abstracts, Section B*, June, 1919. (Abstracted from *Comptes Rendus*, Feb. 24 and March 3, 1919.)

Static Transformers for Use with Electric Furnaces.—The writer states that there are distinct reasons for developing a special type of transformer for furnace work and that, generally speaking, standard transformers are unsuitable. For example, a voltage ratio requiring a range of 65 to 85 volts, or possibly a wider range, is not in general requirement for the standard transformer. In order to obtain these voltages with efficient results, special precautions in design are necessary. As the low voltages are in general use, the heavy current must be cared for, possibly up to 50,000 amp., and in order to obviate unnecessary local heating and heavy voltage drops special technical precautions must be taken. During furnace operation violent and frequent fluctuations of load are met with, which in turn bring heavy mechanical and electrical strains to bear on the windings. This necessitates a robust and heavy construction of windings, core and leads. The internal reactance in furnace transformers is usually higher than in power transformers. With the rapid fluctuation of load possible, voltage surges may be encountered on the high-tension side of the transformer, necessitating heavily reinforced end-turn insulation. Owing to this the tappings for voltage regulation should be internal to the winding whenever possible so as to leave the reinforced turns free from any break in their insulation. Heavy and frequent overloads must be allowed for and out-of-balance loads must be provided against in such manner that the voltage does not fall away in consequence of the preventive means adopted.—London *Electrician*, July, 1919.

Generation, Transmission and Distribution

Water-Power Investigations.—In considering the water-power problem in the United Kingdom it has been found advisable to investigate the success which has been possible in Canada under government direction.—London *Times Engineering Supplement*, June, 1919.

Problems in High-Tension Power Transmission.—W. P. DOBSON.—The writer deals with high-tension disturbances in transmission systems and indicates the



OSCILLATION PRODUCED BY HIGH-TENSION SWITCHING

problems involved in dealing with them. A number of oscillograms are offered showing disturbances of this kind.—*Sibley Journal*, August, 1919.

Suspension Cables.—G. L. LE COCO.—For a cable under any system of loading the ordinate at any point is equal to the sum of the moments at that point divided by the horizontal tension. The cases of a single concentrated load and of a uniformly distributed load are considered. This analysis can safely be applied to determine the section of a suspension cable.—*Science Abstracts, Section B*, June, 1919. (Abstracted from *Comptes Rendus*, April, 1919.)

Theory of Probabilities Applied to Failures of Suspension Insulators.—L. M. KLAUBER.—Notwithstanding the recent improvements in porcelain insulators, failures are sufficiently common to make allowance for them obligatory. A certain factor of safety is required, in the shape of extra insulation, to provide for the electrical unreliability of the insulators themselves aside from conditions of abnormal operating stresses. There are a wide variety of operating conditions which affect the amount of over-insulation required, and after having found the minimum number of insulators per string required for any given operating conditions the author points out a method of determining the amount of extra insulation desirable from an insurance standpoint according to the law of probabilities. Equations are developed from which the probabilities of failure for any given cases, or the ratio between such probabilities for any pair of cases, may be determined directly. A numerical example is also given which shows the development of the theory of minimum annual cost for combined mechanical and electrical failures.—*Proceedings A. I. E. E.*, August, 1919.

Characteristics of Illinois Coal and How to Burn It.—T. A. MARSH.—Illinois coals are treated according to the bed and the district from which they come. The accompanying tables give typical analyses of Illinois coals

TABLE I—TYPICAL ANALYSES OF ILLINOIS SCREENINGS BY DISTRICTS AND BEDS

Coal by District and Bed	Moisture	Volatile	Fixed Carbon	Ash	Sulphur*	B.t.u. Commercial	B.t.u. Dry Basis	Fusion Temp. of Ash
District No. 1.....	11.92	33.28	34.64	20.16	4.50	9,509	10,796	2,025
La Salle Co. No. 2 coal								
District No. 2.....	9.28	31.97	49.00	9.75	1.29	11,975	13,199	2,425
Jackson Co. No. 2 coal								
District No. 3.....	13.46	34.5	34.54	17.5	4.8	9,808	11,334	2,050
Rock Is. Mercer Co. No. 1 coal								
District No. 4.....	13.00	34.8	37.00	15.2	4.5	10,353	11,900	2,179
Springfield Nos. 5 and 6.....	12.2	33.2	35.00	19.6	4.00	9,719	11,070	....
Peoria No. 5 coal								
District No. 5.....	6.75	33.49	46.72	13.04	3.00	11,493	12,325	2,291
Harrisburg No. 5 coal								
District No. 6.....	8.00	33.00	45.5	13.5	2.25	11,362	12,350	2,350
Herrin No. 6 coal								
District No. 7.....	12.56	34.00	34.44	19.00	4.80	9,813	11,222	2,091
Belleville No. 6 coal								
District No. 8-1....	14.45	36.55	36.00	13.00	2.55	10,500	12,274	2,175
Grape Creek No. 6 coal								
District No. 8-b....	12.99	35.55	35.0	16.46	2.93	10,070	11,575	2,125
Danville No. 7 coal								

* Separate determination.

TABLE II—CHAIN-GRATE PERFORMANCE WITH ILLINOIS COALS

Test No.	1	2
Type of boiler	Stirling	Edge Moor
Type of grate	Green-type K	Green-type K
Area of grate, 29-ft	99	100
Ratio of grate area to heating surface	50.66	52.8
Duration of test, hours	8	4
Horsepower rating of boiler	501	528
Name of fuel	Harrisburg No. 5	Franklin No. 6
Size of fuel	1½-in. screenings	Screenings
Moisture, per cent	9.5	5.6
Volatile, per cent	30.01	26
Fixed carbon, per cent	50.94	53.6
Ash, per cent	11.35	12.1
Sulphur, per cent	3.79	.....
B.t.u., commercial	12,000	11,572
B.t.u., dry basis	13,270	12,250
Furnace draft, in.	0.34	0.58
Uptake draft, in.	0.73	1.37
Coal per square foot of grate area per hour, lb.	31.4	48.21
Per cent. rating developed	164	244
Combined efficiency, per cent	74.74	71.25

and data concerning the boilers best adapted to burning these coals smokelessly and at high efficiency on the chain grate.—*Power*, July 15, 1919.

Traction

Why Rails in Regular Use Do Not Rust.—O. P. WATTS.—The author reviews at length the observations made since 1843 on the fact that idle rails appear to rust faster than those in regular use. He criticises some of the attempted explanations and shows by experiment that they are not valid. Believing galvanic action to be chiefly responsible for the protection of the "busy" rails, measurements were made which showed the used head of a "busy" rail to be electrically positive to the rest of the rail. Confirmatory tests were made by straining (cold-working) iron rods, showing the worked part to be electro-positive to the unworked. —*Science Abstracts, Section B*, June, 1919. (Abstracted from *A. E. S. Trans.*, Vol. 33, pp. 173-180, 1919.)

Electrification of Railways.—At a recent meeting of the Société Française des Electriciens, the new president, M. N. Mazan, spoke on the electrification of railways. The problem consists in equipping the various sections of the line according to the needs of the service. The sections into which the line may be divided according to this basis average 15 km. to 30 km. in length, for which fairly high voltages are required. A comparison is made of three-phase, single-phase and high-tension direct-current systems. The three-phase system is rejected on account of the lack of flexibility of the motors and complication of the supply line. The single-phase system is undesirable owing to the weight of the electric equipment required. Direct current should be used at a voltage of 3000. The two tracks in a double-track system should be completely independent of each other. Electrification of the line has the advantage of enabling improvements to be made in lighting the sections, and it facilitates the use of electric auxiliary machinery and the development of electric transmission lines. The French government has appointed a commission to examine the question of the electrification of the French railways.—*Review of Foreign Press Technical Supplement*, June 24, 1919. (Abstracted from *Revue Générale de l'Electricité*, May 17, 1919.)

Installations, Systems and Appliances

Electricity for Heat Treatment in the Steel Industry.—THADDEUS F. BAILY.—The author deals with the use of electric heating for soaking pits, reheating and annealing furnaces.—*Electrical Review*, July 26, 1919.

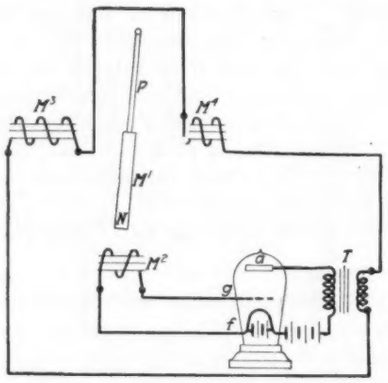
Reverse-Current Relays—Principles of Operation.—VICTOR H. TODD.—The construction and operation of reverse-current relays is set forth with a plentiful series of illustrations to make the discussion readily understood.—*Power*, July 15, 1919.

Electric Welding: Its Theory and Practice.—H. S. MARQUAND.—In this number of the series the author deals particularly with the application of arc welding. He states that the application is steadily extending in carrying out such work as varied kinds of ship construction and repair work, repairs to steel castings, repairs to steel and iron forgings, repairs to cast-iron and malleable-iron castings, manufacture of pipe of all shapes and sizes, all kinds of tramway repair and constructural work, both factory and track work, manufacture of tanks, barrels, seamless boats, drums, cylinders, boilers, steel wagons, motor cars, vats for breweries, converter shells, annealing pots, transformer housings, oil refinery equipment, cotton-mill machinery, fans and blowers, repairs to rolling-mill wabblers and pinions, repairs to automobile parts, toothed wheels, building up of worm shafting and many other phases of engineering construction.—London *Electrician*, July 11, 1919.

Flexible Electric Heater.—R. HEILBRUN.—The description of heating appliances with flexible heating units made for war purposes is continued. Masks for airmen were made to cover the upper portion of the face or the whole face. The celluloid eyepieces were protected from deposits of moisture by the provision of heaters. In one design the oxygen mask and heating mask were combined. Openings were provided for applying receivers for wireless. The control of the various

heaters used by airmen was placed in belts supporting switches and sockets. Zinc flexible wire was generally used. A neat form of pin plug is illustrated which prevents the pin from falling out of the socket. The choice of the energy consumption required for heaters for various purposes and under different conditions is discussed. In conclusion it is argued that the devices developed for war purposes should find application to peaceful purposes. For instance, electrically heated overalls might be used to envelop persons rescued from drowning or to clothe the navigators of boats.—*Review of Foreign Press Technical Supplement*, June 24, 1919. (Abstracted from *Elektrot. Kraftbet. Bahnen*, March 24, 1919.)

Sustaining Oscillations.—H. L. KIRK.—The writer has designed a method for the regulation and actuation of an electric clock. In the diagram p is a pendulum



CIRCUIT FOR ELECTRIC CLOCK

tuned to whatever time period is required; M' is a permanent magnet rigidly fixed to and part of the pendulum; M^2, M^3, M^4, are electromagnets; T is a step-down transformer. p is set in motion, inducing alternating emfs. in M^2 and therefore producing alternating potential differences across gf. This will cause periodic variations in the anode current I, inducing emfs., and corresponding currents in the secondary of T, therefore in M^3 and M^4, which may be in phase with or 180 deg. out of phase with the oscillations of p.—London *Electrician*, July 18, 1919.

Electrophysics and Magnetism

The Flow of Power in Electrical Machines.—J. SLEPIAN.—It is shown that the usual concept of power flow in conducting wires does not correspond to any physical fact, and the necessity is developed for believing in a power flow through the insulating space around the wires. The Poynting vector which gives this power flow is defined and its properties are explained. By means of it the power flow in the reactor, transformer, direct-current generator, alternator, synchronous condenser and induction motor is pictured.—*Electrical Journal*, July, 1919.

Arrangement of Electrons in Atoms and Molecules.—IRVING LANGMUIR.—In this number of the series the author deals with the mechanism of chemical action and the structure and properties of compounds. After pointing out the uncertainties attached to the ordinary textbook conceptions of valency, the author suggests a more general theory of valence. This theory is then applied in elucidating the structure of a large number of organic and inorganic compounds, for some of which it has been impossible to postulate any structure in accordance with the ordinary valence theory.—*General Electric Review*, August, 1919.

Miscellaneous

The General Electric Company in the Great War.—JOHN R. HEWETT.—The author deals with the research that was done by this company, particularly in connection with the X-ray development and submarine detection.—*General Electric Review*, August, 1919.

Standard Specifications for Lake Copper.—This bulletin contains standard specifications as worked out by the American Society for Testing Materials of lake copper wire bars, cakes, slabs, billets, ingots and ingot bars.—*Department of Commerce Industrial Standards, No.* 53.

Army Electrical Work in France.—OLIVER F. ALLEN.—This article gives an interesting insight into the nature of the electrical work in the advanced army areas and the difficulties under which it was performed.—*General Electric Review*, August, 1919.

Government Ownership of Water Power in Relation to Electrochemical Industry.—F. A. J. FITZGERALD.—It is stated that examples of government activities in various fields which can be undertaken by private enterprise offer evidence strongly against public ownership in such cases. An examination of the only adequate example of government ownership of a hydroelectric system shows that all the evils have developed that are associated with governmental activities of this kind, and that the largest individual users of electric energy, the electrochemical industries, will be the most direct sufferers therefrom.—*Chemical and Metallurgical Engineering*, July 15, 1919.

Electrical Insulating Materials.—R. P. JACKSON.—Generally speaking, insulating materials may be divided into organic and inorganic insulators. Among the inorganic insulators may be mentioned porcelain, glass, marble, lava, soapstone, mica, asbestos, etc., while some of the more common organic insulations include paper, cloth, wood, varnishes, gums, asphalts, pitches, waxes, etc., synthetic resins such as bakelite, condensite, redmanol, rubber and similar materials. These insulators are discussed by the author with special reference to their insulating qualities—that is, dielectric strength—mechanical qualities such as absence of brittleness, expansion temperature coefficient, weathering qualities, dielectric losses, etc.—*Electric Journal*, August, 1919.

Constitution and Microstructure of Silica Bricks.—HERBERT INSLEY and A. A. KLEIN.—The investigation involved a petrographic microscopic study of test cubes and commercial silica bricks some of which had received repeated burnings by use in kilns. Quartz, cristobalite and tridymite are the main constituents. Small amounts of pseudo-wollastonite and glass are present. Long burning at temperatures slightly less than 1470 deg. C. causes the formation of a large percentage of tridymite. Cristobalite characterizes higher-burned brick. Quartz first inverts to cristobalite in the fine-grained ground mass and along cracks caused by shattering on heating, and then to tridymite if the temperature does not exceed 1470 deg. C. The lime added in grinding aids more as a flux than as a bond. Most of the cementing action in the burned product comes from the interlocking of the quartz, cristobalite and tridymite crystals.—*Technical Paper No.* 124, U. S. Bureau of Standards, July 11, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

UTILITY QUESTIONS AMONG MOST IMPORTANT OF TIMES

Chairman Higgins of Connecticut Commission Says that Private Ownership with Careful but General Public Regulation Is Preferable

Chairman Richard T. Higgins of the Connecticut Public Utilities Commission made an address on Tuesday of this week before the section of utility law of the American Bar Association at Boston. He declared: "The legal, financial and administrative questions pertaining to utility companies are among the most important that confront the American people in this important era of readjustment, reconstruction and the adapting of existing facilities to the unusual conditions and requirements of the present day."

"The problems involved at the present time," said Mr. Higgins, "are not so much interpretation and application of existing laws as they are legislative and administrative problems of enacting laws and adopting administrative policies which will permit utility companies to continue business and receive fair returns for the work and capital required."

In referring to the position of utilities under regulation, Chairman Higgins said that many of these properties are in a critical condition, preventing the rendering of proper service and seriously affecting the public welfare. He expressed the opinion that the unfortunate just or unjust antipathy which the general public has had in the past toward public utility companies prevented a raise in the price of their commodity in keeping with the increasing cost of production.

The speaker referred to the constructive era when privately owned utilities were not under strict public regulation, saying that the spirit of human avarice and arrogance crept into many of the companies and high and unlawful financing were resorted to, resulting in detriment not only to the general public but to the company as well. When these facts become known a feeling of resentment and antagonism developed in the public mind.

Mr. Higgins then took up the subject of public ownership, saying that many people possessed the idea that this would come the nearest to being a Utopian policy for handling public utilities. "During the past two years," he continued, "we have had a practical experience of government control with practically all the powers of government ownership. The innumerable difficulties which the government had to contend with are generally recognized. Curtailment of service has been experienced, and notwithstanding increases in rates financial deficits have followed, strikes have taken place and service been temporarily or partly suspended. Whatever merit there may be in government ownership or control, we have learned from experience that it is not a panacea for utility ailments. Even with material increases in rates on steam railroads under government control, the financial results are on the wrong side of the balance sheet, labor troubles are not eliminated and strikes affecting service and threatening the social and industrial life of the nation occur.

"Whatever the sentiment may have been in the past, it appears to be an almost universal sentiment to-day, with the exception of certain utility employees, that private ownership with careful but general and authoritative public regulation is preferable to government ownership or control.

"The corporate greed that sometimes creeps into privately owned companies may not be more detrimental than the political influence which government ownership under a democratic form of government is liable to encounter, but proper and careful public regulation should eliminate the opportunity for graft and unlawful speculation on the part of the privately owned companies.

"If credit can be reëstablished and utilities given a fair chance in the field of enterprise, with a reasonable prospect for a fair return on the necessary capital invested and new capital to be invested, there is no reason why sufficient private capital should not be available for the operation of our public utilities without adding that business and administrative burden and possible financial and taxing obligation on our already heavily burdened governments, both state and national.

"It is conceded that public regulation of utilities is for public protection, but the further removed the seat of power is from the actual business regulated the more onerous become the regulatory requirements, particularly in the matter of delays or uncertain requirements.

"The supplying of a public utility is a public function, and the officers of a company specially chartered and undertaking to supply such service are public servants and should be amenable to the public for malfeasance in office. Not only the officers but all the employees necessarily engaged in the production and supply of a public utility are public servants and should be amenable to the public for the faithful and continuous performance of their voluntarily undertaken duties. Acting as such servants, the public should be protected against the suspension of a vital necessity by strikes, labor demands or other questions of dispute arising between two factions of such public servants.

"Employees of public service companies should receive fair compensation in keeping with the standard wage or a necessary standard wage at the time, but as the public which ultimately pays the bills is vitally more interested than the officers or employees of the company in the maintenance and continuance of dependable service, it should be made unlawful to bring about a total or partial suspension of service by strikes or other internal differences until the public or some official tribunal representing the public interest has had a reasonable opportunity to pass upon the wage demands or other questions of dispute between the officers of the company and its general employees.

"I believe that labor should have its fair compensation and favorable working conditions, and I do not wish to be understood as speaking against the desirability of union or organized labor, which has done much in the uplift of the laboring man's condition; but when a man or combination of men engages in the production and supply of a necessary utility to the public, the public interest is of paramount importance and it should be a penal offence willfully to jeopardize that interest or prevent the supply of a public necessity, at least until some legally constituted tribunal has been resorted to for an adjustment of the matters in dispute.

"This great country, with its more than one hundred millions of free people, is too enlightened, too powerful and too progressive to permit a comparatively small combination of men or an aggregation of capital, be it large or small, to jeopardize or dominate the public interest and the public necessities or to prevent the enactment and enforcement of ample protective legislation."

Rumford Falls, Me., Has Surplus Power

The Rumford Falls Power Company, Rumford, Me., and the Rumford Chamber of Commerce have issued a booklet describing the industrial advantages offered by the community. The company has a large amount of hydroelectric power available for sale at low rates. Rumford Falls has the greatest single water power in New England, greater than the combined powers that have developed Lewiston, Me., and Lowell, Lawrence and Holyoke, Mass., into thriving and populous centers. The new station, completed in 1918, has a capacity of 30,000 hp., which can be increased to 45,000 hp.

PEACE TREATY CLAUSES CONCERNING PATENT RIGHTS

Study of Document Shows Many Points Which Are of Favorable Interest to Inventors and Patent Holders

The industrial property section of the peace treaty, as it appears in the *Congressional Record*, provides for extension of time for filing applications for foreign patents and for reviving foreign applications or patents which have lapsed during the war in the contracting countries, according to Clarence J. Loftus of Chicago, counselor in patent and trademark causes. Among other things, he says, this section in substance provides:

1. That at any time within six months from the coming into force of the treaty convention applications may be filed in convention countries based upon applications filed subsequent to July 31, 1913. Heretofore it has been necessary to file such applications within twelve months from date of filing application in the home country.
2. That the necessary steps for the prosecution of pending applications can be taken within one year from the coming into force of the treaty.
3. That taxes not paid during the war may be paid now or any time within one year from the coming into force of the treaty.
4. That the failure to work patents in countries where the law requires them to be worked will not forfeit the patent or constitute a ground of revocation of the patent for a period of one year from the coming into force of the treaty.
5. That as to patents in force on Aug. 1, 1914, no working is required for a period of two years from the coming into force of the treaty.
6. That no action can be maintained by German nationals based on the manufacture, sale or use of industrial property rights during the war where such manufacture, sale or use was made by the government of the allied or associated powers or by any one acting on behalf or with the assent of such government.
7. That assignments made during the war which might defeat the objects of the present treaty may be considered void by the allied or associated powers.

APPOINTMENT OF TWO OF THE N. E. L. A. COMMITTEE CHAIRMEN

J. F. Gilchrist Will Be Head of New Committee on Public Information and F. T. Griffith of Committee on Water-Power Development

President R. H. Ballard of the National Electric Light Association announces the acceptance by John F. Gilchrist, vice-president of the Commonwealth Edison Company of Chicago, of the chairmanship of the committee on public information, and also by Franklin T. Griffith, president of the Portland (Ore.) Railway, Light & Power Company, of the chairmanship of the committee on water-power development. These important committees will have valuable and instructive reports to submit to the national convention of 1920, which will be held in southern California.

The committee on public information is a new committee, and Mr. Gilchrist will organize it by establishing in each state or geographical section a local committee which will finance itself and furnish news bulletins to the press through member companies. Recommendation of men selected as chairmen of committees in various states for appointment as members of the general committee will be made by Mr. Gilchrist

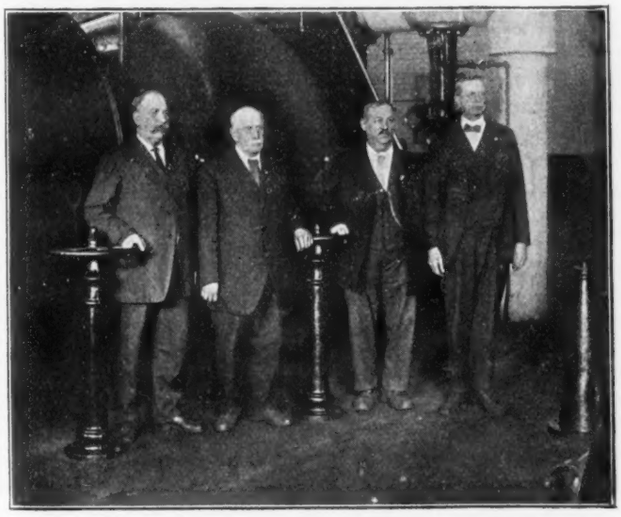
and will be submitted for approval to the president and be acted upon by the executive committee of the association.

This will be a very large committee, but as its work will be largely devoted to states and geographical sections, it is unlikely that its entire membership will ever be called to meet. Thus its proportions will not be objectionable. Mr. Gilchrist was instrumental in starting a movement along these lines in Illinois which proved very successful. It is believed that to extend it to every state in which company members may desire assistance will accelerate its effectiveness.

The committee appointed on water-power develpment, which will be under the direction of Mr. Griffith and in which he will associate with himself prominent executives from all of the Pacific Coast companies and also some of the executives from Eastern companies, has before it an enormous scope for its activities. The purpose of its organization is to investigate and encourage water-power development, and it is the first general committee of the association to take up this most important feature of the electrical industry.

The Department of the Interior, the War Industry Board and other bodies have collected a great amount of data in relation to the problems of water-power development. Mr. Griffith's committee will not only collect and codify the information gathered by these bodies, putting it into workable shape for the use of geographical sections and central states, but when there seems to be a necessity will pursue a line of original investigation. The necessity for conservation of the natural resources of the nation, the impending shortage of both coal and other fuel and the probability of large increases in the demand for electric energy because of railroad electrification make the work of this committee of paramount importance, and its report will be of the greatest assistance in the large financing which extensive water development will involve.

Long-Service Employees at Salem, Mass.



Combined terms of service of these plant engineers in the station of the Salem (Mass.) Electric Lighting Company exceed a century. From left to right they are: George F. Ross, September, 1886, engineer; Charles E. Brown, May, 1896, engineer; Everett H. Neagles, November, 1891, engineer, and William H. Barnard, November, 1889, chief engineer.

Aims of the Geographic Sections of the National Electric Light Association

Responding to a request for his ideas in relation to the scope and objects of the geographic sections, President R. H. Ballard of the National Electric Light Association transmitted to President Thomas Sproule of the Pennsylvania Electric Association the following, in communication form, in connection with a letter expressing regret at his inability to attend the convention of that organization which convened at Bedford Springs on Sept. 4:

"In the geographic section we provide the electrical industry with the intermediary link between the central station, which is the unit of activity from which ideas naturally germinate, and the National Electric Light Association, which is transcontinental in its policies and its aims.

"In the geographic section the greatest opportunity is offered for personal contact and interchange of ideas between executives and employees of the companies and all others interested in the electrical industry within the territory where conditions are frequently identical and usually similar.

"In the geographic section the results of progress made and new ideas demonstrated by one company may be quickly conveyed to other companies in the same territory.

"In the geographic section opportunity is afforded men to think in broader terms and to apply their reasoning along sectional lines. This is the logical sequence of development—company to section, section to nation. The natural foundation for this line of progress is the company sections, and its importance is inestimable.

"In the geographic section the maximum opportunity is presented for cementing all branches of the industry into one harmonious whole, of increasing the sphere of influence exercised by those engaged in our profession, and of eventually creating a better understanding between the public served and those whose duty it is to serve the public.

"In the geographic section a complete understanding should be reached between central stations, manufacturers, jobbers and contractor-dealers as to the rightful place in the industry occupied by each group and in establishing the relations of one branch of the industry to the others.

"In the geographic section we have a place where misunderstandings, frictions, petty jealousies and fancied injuries can be ironed out and adjusted by bringing about a full and complete realization by all members of the section of the responsibility of service to the public and the joy of working out practical accomplishments of the ideal.

"In the geographic section can best be worked out a definite plan by which the public may be kept informed on the true status of utility service in the district served.

"In the geographic section there is ample opportunity for constructive initiative, and the opportunities for its exercise could be amplified indefinitely, the scope of achievement having no limitation but brains and ability.

"In the geographic section we have the medium of crystallization, demonstrating and applying locally when local, and making universal when universal, all of the constructive creative forces that exist in the minds of the great membership of the National Electric Light Association."

AIRPLANE VIEW OF MASSACHUSETTS INSTITUTE OF TECHNOLOGY BUILDINGS

BOSTON "TECH" SEEKS A FUND OF $10,000,000

Prominent Men Will Work to Secure Funds in Order that Needs of the Institution May Be Met Adequately

A country-wide campaign for $10,000,000 for an endowment fund has been started by the Massachusetts Institute of Technology. It will last until Jan. 1. Gen. T. Coleman du Pont heads the committee which has charge of the drive. The other members are Theodore N. Vail, Charles A. Stone, Otto H. Kahn and Charles Hayden, New York; Everett Morss, Boston; Edmund Hayes, Buffalo, and Dr. Richard C. MacLaurin, president of the institute.

Announcement was also made that the "mysterious Mr. Smith," who has already given the institution $7,000,000, has offered to present another $4,000,000 on condition that a like sum be given by others.

Funds are needed by the institute to meet higher expenses. A statement issued by the committee says: "The tuition fee has been raised from $250 to $300. It already shuts out men who should have the opportunity to enter its courses. It must not be raised further. Even $300 meets only about one-third the expense of each student. Eight million dollars should be added to the endowment fund in order to pay the faculty adequately and make it possible to accommodate the increasing number of students who are applying."

PURCHASE OF MARCONI WIRELESS STOCK PLAN

Acquisition of Interest of English Company Contemplated by American Holders—General Electric Company to Be a Stockholder

If negotiations now under way are completed, part of the stock of the Marconi Wireless Telegraph Company of America which is owned by the Marconi Wireless Company of England will be bought by interests connected with the American company. The English interest in the American company is a minority one, and its acquisition would mean important changes. It is understood the General Electric Company will become a stockholder in the American company under the new plan. Under the new arrangement the stock of the Marconi company will be owned exclusively by Americans. The company will not be a subsidiary of the General Electric Company but will be operated independently. The General Electric Company has become interested because of its ownership of patents on wireless equipment. It developed the Alexanderson alternator.

ACTIVITIES OF THE N. E. L. A. ELECTRIC VEHICLE SECTION

The Society of Automotive Engineers Has Suggested Electric Transportation Division of Its Standards Committee

A meeting of the executive committee of the Electric Vehicle Section of the National Electric Light Association was held recently at the New York headquarters. Chairman George B. Foster presided.

E. R. Whitney, who accepted appointment as chairman of the standardization committee, announced that the Society of Automotive Engineers had suggested the formation of an electric transportation division of its standards committee, of which E. P. Chalfant had been suggested as chairman. The division would be divided into the following sections: Electric commerical vehicles, electric passenger cars, electric industrial trucks and tractors, electric storage batteries and electric wheel chairs, with the possibility of an accessories section. The chairmen of these sections, together with the chairman of the division, constituting the executive committee of the division, would report to the main standards committee of the Society of Automotive Engineers.

There was no report from the legislation committee, but during the meeting G. A. Freeman agreed to accept appointment to chairmanship on this committee.

Secretary Marshall stated that Dr. Carl H. Reed had accepted appointment as chairman of the motion-picture film committee.

It was the consensus of opinion that much valuable work could be undertaken by the federal and municipal transportation committee this year, notably immediate coöperation with the New York-New Jersey Port and Harbor Development Commission, for which B. F. Cresson is consulting engineer.

F. M. Feiker, chairman transportation engineering committee, stated that the committee had developed a national list of users of electric trucks, which, though not complete, at least included the most representative users. Questionnaires are being sent in an effort to ascertain operating cost data, etc. It was decided to merge the manufacturers and central-station coöperation committee with the transportation engineering committee.

STATUS OF ELECTRICITY SUPPLY IN GREAT BRITAIN

Major Philip Dawson Says that Public Should Not Be Encouraged to Expect Revolutionary Changes from Super-Power Stations

An address made recently by Major Philip Dawson before the Association of British Chambers of Commerce on "The Position of the Electricity Supply of the United Kingdom" dealt with the problems which the British government is now trying to meet through new legislation. Major Dawson said that past experience had shown:

(a) That large generating stations have taken from fifteen to twenty years to be fully loaded, and their entire plant was scrapped or superseded during that period.

(b) Cables laid to develop districts have not been used for years.

(c) So far as the average prospective consumer is concerned the great increase in the cost of wiring, due to after-war conditions, is likely to act as a deterrent to his adopting electricity for domestic purposes, and it is impossible to get the public to arrange to take a supply of electricity until it is at their doors, and this entails capital expenditure lying idle in districts where electricity has not hitherto been available.

(d) Owing to the improvements in the industry there is every possibility of the present-day plant being out of date in ten years' time. Why, therefore, can we say to-day that things are at finality?

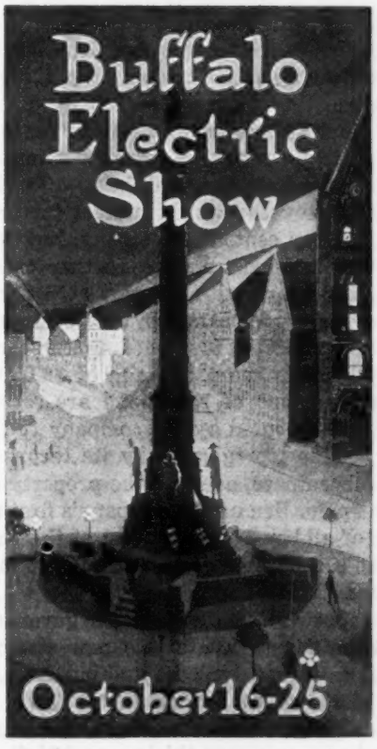
Furthermore, Major Dawson pointed out, the fact seemed to have been overlooked that where loads are distant from each other it might be more economical to use two or more smaller stations rather than to incur the great cost of mains for transmission and distribution.

Super-stations were and would be necessary and advantageous in many cases, but only where the load existed or could immediately be obtained to justify their erection. Otherwise one of two things must happen, either existing undertakings would have to be shut down and the capital invested written off as a loss, or the super-station would stand partly idle and not only work uneconomically but also have to bear the heavy burden of the capital and other fixed charges divided over a small output. Much had been made, and rightly, of the possibility of utilizing coal for electric generation and at the same time obtaining all the by-products. The commercial soundness of this was not yet proved, and while power station sites should be sufficiently extended and so located as to permit such methods to be put into practice at a later date, there was no immediate prospect of success in this direction. In certain instances near collieries, blast furnaces, coke ovens, etc., great economy was rendered possible by utilizing the waste gases for electric generation and pumping into a distribution system. While deprecating too sanguine expectations as regards the cheapening of electricity supply which may be brought about by the new legislation now under consideration, it is essential, said Major Dawson, that undertakers in densely populated industrial areas of the country should not be allowed to continue to develop their undertakings independently of each other, but that their efforts and their outputs should be coördinated and, if advisable, amalgamated. This would appear to mean a monopoly, which would require proper regulation and supervision.

The industrial areas should first be taken in hand and coördination and coöperation between existing undertakers obtained, and satisfactory results could in many instances be achieved without the erection of any very numerous new super-stations. Next the electrification of railways, where experience has shown such a step to be profitable or advisable, should be taken in conjunction with industrial and private electricity supply, and it would appear inadvisable that such additional stations as traction may require, in whole or in part, should be put down or operated by the railway authorities whose undertakings have to be run on entirely different lines from those of the electric supply business. State assistance may in certain cases be necessary, but it should only be rendered on proper commercial lines. The electric supply industry where properly installed and managed is a stable one and offers safe investment for capital, provided that it is not hampered as it has been by unfair legislation, and hence there did not seem, said the lecturer, to be a very strong case for the state taking over the electric supply industry any more than for its taking over the gas industry.

Major Dawson declared that the public should not be encouraged to expect revolutionary changes due to the immediate erection of a large number of super-power stations all over the country, from which in many cases harm rather than good might result. A far sounder and more profitable policy for all concerned would be brought about by coördination and coöperation and possibly by amalgamation of existing undertakings, whether owned by a municipality or a company.

Buffalo Will Have Electric Show



Buffalo will have an electric show from Oct. 16 to 25. Owing to the world war no electrical show has been held in that city since March, 1914, but it is now the opinion of the electrical fraternity there that a show should be held to stimulate local business and enable the public at large to become familiar with recent developments. The Empire State Gas & Electric Association will hold its meeting in Buffalo on Oct. 24.

WEST PENN POWER SYSTEM UNDER CONDITIONS OF WAR

Terms of Arrangement with Government for Construction of New Springdale Power Station and Appraisal of Value

An account of various construction projects, including the one in which the federal government assisted the West Penn Power Company, is given by A. M. Lynn, president of this company and the allied West Penn Traction & Water Power Company and West Penn Railways Company, in his report to stockholders for 1918.

"The constantly increasing recognition by power users of the advantages of central-station power and the war activities created a demand upon the West Penn system that rendered imperative the material enlargement of its power generating capacity," said Mr. Lynn. "This situation was recognized as being so important by the national government that it entered into a contract on Aug. 3, 1918, under which the company agreed to undertake promptly the construction of a steam power station of 40,000 kw. capacity at Springdale, on the Allegheny River near Pittsburgh, with the necessary transmission lines to connect with the existing system of the company, all at an estimated cost of $5,000,000. The government agreed to provide for 40 per cent of the cost of the work and to advance to the company $2,000,000 on account thereof, the company to provide the remaining 60 per cent. The government promptly paid the $2,000,000; work was immediately started and has since progressed satisfactorily.

"The contract further provides for an appraisal of the power station and transmission lines as of a date three years after the termination of the war, and the amount by which the then reproduction cost less allowances for obsolesence and depreciation exceeds the portion of the cost of the same theretofore provided for by the company out of funds other than those advanced by the government is to be repaid to the government by the company five years from the final fixing of such amount by the appraisal, together with interest in the interval at the rate of 5 per cent, the company, however, to be entitled, should it so desire, to a further extension of two and one-half years with interest at 6 per cent.

"To secure the performance by the company of the terms of the contract it furnished to the government an indemnity bond in the penal sum of $3,000,000, and the performance terms of said bond are secured by a second mortgage executed by the company to the Secretary of War. This mortgage is by its terms expressly subject and subordinate, as to all the property embraced therein, to the prior lien of the company's first mortgage to the extent of all bonds outstanding at the time of the making of the second mortgage and all that may thereafter be issued.

"With the approval of the national government, the company determined to locate this new station on the Allegheny River, where, by lease and purchase, approximately 3900 acres of coal lands in the Twin Freeport area were secured. This is a high-quality steaming coal and the seam has an average thickness of 7½ ft. (2.2 m.). By locating the power station at the coal mine a saving in freight charges of over $100,000 per year will result on the initial installation of 40,000 kw.

"During the year the West Penn Power Company added to the Connellsville power station 1371 hp. of rated boiler capacity, designed to operate on peak loads at 300 per cent rating. This, together with a thorough overhauling of several of the generating units, materially increased the output and efficiency of the station.

"The new Windsor power station of the West Penn Power Company on the Ohio River at Beech Bottom, W. Va., was placed in operation just prior to Jan. 1, 1918. Adjoining this plant and under the same roof is a station of like design owned by the Central Power Company, the two stations having been designed and constructed for combined operation, thus securing economy and reliability. Each station now has 30,000 kw. rated capacity in operation and the Central Power Company is adding capacity of 60,000 kw. The layout of the station is such that the West Penn Power Company may from time to time increase the capacity of its station to an ultimate of 120,000 kw."

Telephone Club in New York

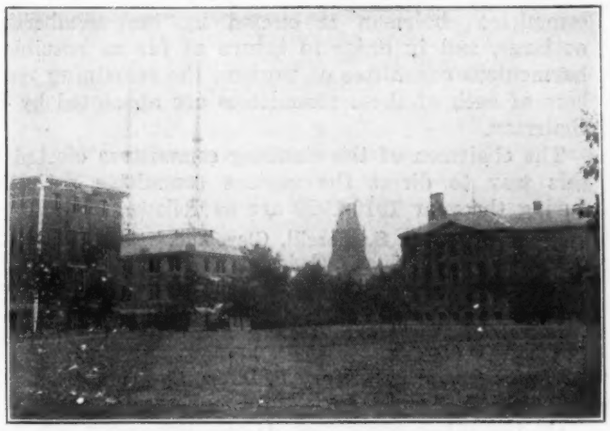
The Telephone Society of New York and the Telephone Club have been consolidated as the Telephone Society, Inc., in order to afford all male employees of the Bell system in and around New York a social center and the facilities of a fully equipped club house and also an organization for carrying on these activities and conducting entertainments and other meetings on a large scale, both indoors and outdoors. The club house is at 353 West Seventeenth Street. The following constitute the board of directors: J. A. Stewart, general manager New York Telephone Company; Bancroft Gherardi, chief engineer American Telephone & Telegraph Company, and F. B. Jewett, chief engineer Western Electric Company. H. W. Casler, division publicity manager, is president of the society. The dues are $1 a year.

ENGINEERING RESEARCH WORK IMPORTANT COLLEGE FUNCTION

Dean C. A. Adams of New Harvard Engineering School Says Manufacturers Are Going More and More to Engineering Schools for Help

Dean C. A. Adams of the new Harvard Engineering School discussed recently at Cambridge, Mass., the aims of the new institution and higher engineering education. In speaking of the scope of the work planned, Dean Adams said that under the McKay will it is necessary to give undergraduate as well as graduate instruction.

"We shall, in addition to this undergraduate work," he added, "give and emphasize as much as possible graduate study and research, which is an important phase of our plan. It is safe to say that most of the rapid or long strides which have been made in the development of our industries are the result of research. It doesn't make any difference whether you call it engineering research or scientific research; there is no line between them, just as there is no line between pure science and applied science. Such a distinction is nonsense; if applied science is taught in such a way that it is not pure science, it is not science at all. If pure science is taught without reference to its application and without interest in its application, it is not effective. The work of engineering research is one of the most important functions of a real engineering school to-day. Our manufacturers are beginning to realize this and more and more are coming to the engineering schools for assistance, even when they have research laboratories of their own.



HARVARD ENGINEERING SCHOOL

The principal buildings shown, from left to right, are the wing of Pierce Hall, the Cruft high-tension and radio laboratory, where the United States Naval Radio School was held during the war, and the Jefferson physics laboratory. The tower of Memorial Hall is at the rear in the center.

"Next as to our ideals and our aims. First of all, we aim to teach men to think rather than to cram their heads with facts, however useful these may be. We try to provide the men with a broad, sound foundation on which they can safely build. We do not try to build the entire superstructure. By this I do not mean that we are going to neglect the practical applications—that we are going to give a kind of high-brow theoretical education which is of so little interest to the student that he doesn't get anything out of it—quite to the contrary. We shall supply enough of the practical applications as we go along to make the work interesting and to demonstrate its usefulness; but as you cannot cover all possible applications, you must give a student such a thorough grasp of the fundamentals as will enable him to apply them not only to familiar conditions but also to solve new problems. In short, we hope to train men to be real engineers, leaders in their profession, not handbook engineers. And the greatest need in the profession to-day is for men of this type.

"We cannot expect that all our students will be of the first quality, but we can and do expect them at least to acquire a habit of mind which will not only influence their engineering work and make them better engineers if they continue to follow their profession but will make them better citizens. The common habit of loose thinking, of crooked thinking, is not confined to engineering. We find it in every branch of human activity. What we aim to develop above everything is the habit of clean, straight thinking, and that means character."

STOCKHOLDERS CAN HELP HIGHER RATE MOVEMENTS

President Brewer of American Public Utilities Company Urges that They Aid in Disseminating Information on Increased Costs

The need of increased rates and the desirability of coöperation by stockholders in the dissemination of information as to public utility conditions are emphasized by Joseph H. Brewer, president American Public Utilities Company, Grand Rapids, Mich., in his annual report. Mr. Brewer says:

Increases in income are confidently expected to accrue from revisions of rates now in progress or to be applied for in the near future. The President of the United States and other government officials, private citizens of nation-wide reputation, prominent labor leaders and practically all the financial publications of the country have made repeated statements strongly recommending prompt and decisive action calculated to insure the maintenance of public utility properties and fair returns to the investors who have furnished the funds with which they have been financed, and a better state of public opinion on this subject and a more thorough realization of the necessities of the utilities by regulating bodies is relied upon to bring about betterment.

Stockholders can materially assist the management of this and other similar companies by the dissemination of accurate information regarding the necessity for increased rates, the effect of which will be to make it easier for the members of rate-regulating bodies to allow utility companies to charge for the services rendered rates in keeping with increased cost of production and delivery to consumers. The coöperation and aid of the stockholders along these lines is urgently requested by the officers and directors.

Mr. Brewer declares that the deliberation of rate-making authorities in acting upon applications for relief from the higher costs of operation "is excusable, to some extent, on the ground that the rate-making bodies have not been able to bring themselves to believe that the scale of prices for all commodities which has ruled in the United States since the beginning of the war would be permanent." He continued:

The present condition of public utilities operators, this company no less than others, is one of endeavor to procure permanent orders affecting rates which will give assurance of adequate income to enable them to render service profitably. It is bginning to be realized by the rate-making bodies that utilities which use large quantities of coal are not going to enjoy in the future any great reductions in the cost thereof, for the reason that any drop in the price of coal at the mine is more than made up by the actual and threatened advances in freight rates.

NORTH DAKOTA COMMITTEE ON ELECTRICAL INTERFERENCE

Railway Commissioners of That State Will Be Advised by Six Engineers, Two Public Service Representatives and Four Signal-Circuit Men

A committee has been selected to draft rules and regulations to be submitted with recommendations for adoption by the Board of Railway Commissioners of the State of North Dakota in connection with administration of the law recently enacted for the regulation of the construction, reconstruction, operation and maintenance of electric supply and signal lines upon highways and public places. The personnel of the committee follows: R. H. Fair, chairman, engineering department Northwestern Group of Bell Companies, Omaha, Neb.; S. D. Hood, secretary, superintendent of distribution Northern States Power Company, Minneapolis, Minn.; M. J. Hanson, telegraph engineer Northern Pacific Railway Company, St. Paul, Minn.; A. V. Taylor, electrical engineer Ottertail Power Company, Fergus Falls, Minn.; A. J. McInnes, manager North Dakota Central Company, Coöperative Telegraph Company, Dazey, N. D.; C. E. Winn, plant department Western Union Telegraph Company, Omaha, Neb.

CLOSING CONVENTION SESSIONS OF MICHIGAN SECTION, N. E. L. A.

Afternoons Devoted to Entertainment, Forenoons Crowded with Practical Papers—W. M. Lewis, Muskegon, Elected President

Business sessions in the morning, time for play and entertainment in the afternoon and lectures of general interest at night—this was the general plan of the convention of the Michigan Section, National Electric Light Association, at Ottawa Beach, Mich., Aug. 26, 27 and 28. The entertainment this year was planned to have special appeal to the ladies, and it is now thought that the same general idea will prevail for the 1920 meeting with the object of getting more central-station men to bring their families.

Besides the papers and addresses abstracted in last week's issue of the ELECTRICAL WORLD, four papers were presented at the last session. One was on "Electrical Merchandising," by H. H. Koelbel, Consumers' Power Company, which outlined the company's methods of operating its appliance department at Muskegon, a city of 50,000 population. "Electric Ranges," by R. F. Hotton, Detroit (Mich.) Edison Company, gave the results of tests and experiments which that company has made to determine various factors involved in serving the range load and in operating the ranges themselves. It included tests on range elements, a discussion of range defects and diversity-factor data. This paper was read by Herbert Silvester, Ann Arbor. "Domestic Refrigeration," a paper by E. H. Copeland of the Kelvinator Company, was a discussion of the future of the motor-driven ice box. A paper on insurance written by J. H. Lobban and read by S. L. Ferguson of the Detroit Edison Company contained warnings for the central-station man against practices that may make his company's fire insurance invalid.

The election of officers resulted as follows: President, W. M. Lewis, Muskegon; first vice-president, G. E. Lewis, Ann Arbor; second vice-president, John Swanson, Jackson; executive committee, Thomas Chandler of Sault Ste. Marie, H. A. Fee of Adrian, John Cavanaugh of Benton Harbor, R. C. Keller of Kalamazoo, Earle Milliken of Houghton; secretary-treasurer, Herbert Silvester, Ann Arbor.

NEW CHAIRMEN OF OHIO ASSOCIATION'S COMMITTEES

Most of Them Are Elected by Membership at Large and Other Committee Members Are Appointed by Chairman

The notable work which has been performed by the committees of the Ohio Electric Light Association may be attributed in no small part to the manner in which those committees are made up. Excepting the executive, advisory and finance committees, the members of which are elected at the annual convention, each committee chairman is elected by the membership at large, and in order to insure as far as possible a harmonious committee of workers the remaining members of each of these committees are appointed by its chairman.

The chairmen of the standing committees elected in this way to direct the various committee activities during the year 1919-1920 are as follows:

Illumination—G. S. Merrill, Cleveland.
Meter—J. L. Wright, Toledo
New Business Co-operations (Commercial Lighting and Merchandising Section)—C. G. Eichelberger, Cincinnati.
Industrial Power and Heating Section—J. C. Matthieu, Dayton.
Station Operating—Henry B. Dates, Cleveland.
Transmission and Distribution—W. E. Beatty, Cincinnati.

Of the other commitees, O. H. Hutchings, Dayton, is chairman of the executive committee; W. W. Freeman, Cincinnati, is chairman of the advisory committee, and Mason H. Lytle, Piqua, is chairman of the finance committee.

San Francisco Jewels for Chicago Fair

Projected light reflected from 26,000 jewels from the San Francisco World's Fair will supply the principal illumination at the Electrical Trades Exposition to be held in Chicago, Oct. 11 to 25. An artists' conception of the elaborate Chinese decorative scheme which is planned is shown in this photograph. The central pagoda will be ornamented with the jewels.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Condition of Plant.—A decision of the California Railroad Commission fixing the compensation to be paid by the city of Redding for the distributing system of the Northern California Power Company in that city answers the company's criticism of the commission's method of arriving at the condition of the plant. Declaring that it sees no merit in the criticism, the commission says: "It is desirable that adequate allowance should be made by the commission in rates to take care of depreciation, and such allowance should be surrounded by safeguards which will make certain that they will be used by the utilities for the very purpose for which they are paid by the ratepayers. But, irrespective of whether the allowances are sufficient or insufficient and irrespective of whether they are used properly or improperly, the fact remains that in eminent-domain proceedings it must be the actual condition of the property at the time of the valuation that is to be considered, regardless of the actual amount of the original investment, regardless of whether the owner has accumulated a depreciation reserve or not, and regardless of whether the reserve is built up by the sinking fund or straight-line method. The service condition of the plant as a whole is not entirely reflected by the condition per cent. The condition per cent merely reflects the condition of individual plant items as compared with new and takes no account of the general usefulness and efficiency of these working parts in their relation to the working capacity of the entire machine. If we consider the plant in the light of a machine constructed for the purpose of performing a definite service, it is clear that we cannot actually compute the service condition by a consideration alone of the probable life of the separate working parts. Many other considerations enter into such calculations. Besides the wisdom or unwisdom evidenced in the design or plan of the completed plant and the question of the adaptability of the various parts to the efficient and economical performance of the functions required of them, also a consideration of whether the plant has been overbuilt or underbuilt, there may be many factors other than those involved in the cost and the age of the separate parts which have a direct bearing upon operation of the plant, causing it either to be economical and efficient or wasteful and extravagant. It is to be admitted that a machine which is economical and efficient in operation has a greater value than one that is wasteful and extravagant. That this consideration cannot be included in a computation of the age and the cost of the parts composing the plant is evident."

Steam Station Supplanted by Transmission Line.—In authorizing a schedule of increased rates by the Illinois Northern Utilities Company, the Illinois Public Utilities Commission said on the question of operation of a steam station: "It appears that the city of Aledo was originally served from a steam generating plant, and that the operators of this plant, seeing a possibility of utilizing its exhaust steam, entered upon the business of heating the buildings in the down-town district, using primarily the exhaust steam from the engines driving the electric generators. Upon the purchase of this plant by the Tri-County Light & Power Company means were instituted for the securing of service from a transmission line, and after considerable difficulty, as above recited, such service was instituted, with the result that the steam station in Aledo was valuable to the electric service only as a standby. While, of course, it still performed essential functions in connection with the steam-heating service, so long as the furnishing of steam-heating service was an incidental function of this plant, the expense of its operation naturally was regarded as principally chargeable to the electric service. However, when transmission-line service was instituted the electrical operation of the plant became the minor feature, and the steam-heating service was regarded by the petitioner as the principal reason for its continued maintenance and operation. The effect of this change of attitude is of very serious importance to the steam-heating consumers of Aledo, but the commission cannot subscribe to the theory that this development, doubtless made in the interests of economy, can completely overthrow the former relationships which existed. Steam-heating service was instituted in Aledo, and the consumers of such service were led to believe that the installations which they made on their premises were made for a reasonable period of time, during which steam-heating service would continue to be supplied at rates not unreasonably comparable with those which then existed. The utility realized the benefits of the transmission-line service as later developed, primarily through its electric operations, in that it was able to produce such service and render it in Aledo at a lesser cost than would have been possible with the old steam generating station, provided that the scheme was a financially practicable one. Obviously, since the benefits of this change principally accrued to the electric service, it must likewise be true that the burdens of the change must largely be borne by the electric service. Any other conclusion would be unjust and would result in placing an undue burden upon the heating consumers in Aledo, who entered into their contracts in good faith with the expectation of realizing their benefits for years to come. If the cost of electric service by this scheme of handling the proposition is increased over the cost of service furnished by the steam generating station without a commensurate improvement of service furnished, then the transmission-line scheme is a failure and should not have been entered into in the exercise of good judgment. Many developments of this nature occur, and, if they show a financial saving over a period of years or effect an improvement in service, they constitute an economic good, and in meeting them the utility and the public must coöperate in sharing the benefits and the burdens of the change. In the case at hand it would be obviously improper to place an undue burden upon the heating consumers in Aledo, and the commission will recognize that the electric service must bear its full share of the expense of operating this station, giving consideration to the developments which have brought about the present situation, and also bearing in mind that the entire proposition is predicated upon ample proof that the transmission-line development has constituted an economic good to the public. Under particular conditions existing at present there seems little reason to doubt this."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electrical Supply Jobbers' Association.—The Central Division of the association will hold its next quarterly meeting at the LaSalle Hotel, Chicago, on Sept. 15.

Annual Convention of National Safety Council.—At the annual convention of the National Safety Council, which is to be held at Cleveland, Ohio, from Oct. 1 to 4, the public utilities section will hold a meeting.

Institute of Radio Engineers.—A paper entitled "Radio Direction Changes and Variations of Audibility" was presented by Major Carl Kinsley, Signal Corps, U. S. A., at a meeting of the institute which took place in the Engineering Societies Building, New York City, on the evening of Sept. 3.

Indiana Electric Light Association.—The annual convention of the Indiana Electric Light Association will be held at French Lick Springs, Ind., on Sept. 11 and 12. Thomas Donohue of Lafayette, Ind., secretary of the association, has announced that entertainment features this year will be made unusually attractive both for the delegates and for ladies that may accompany them.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Montana Power Dividend Reduced.—In reducing the rate of dividend on its common stock the Montana Power Company made the following announcement: "Because of decreased earnings due to generally unsatisfactory conditions of business throughout the territory served by this company during the past six months and because of the present unsettled conditions generally prevailing, the directors have deemed it wise to reduce the dividend on the common stock of this company, payable Oct. 1, from $1.25 per share to 75 cents per share."

Resolution on Andrew Carnegie.—The resolution of regret of the engineering societies at the death of Andrew Carnegie says: "Resolved, That the American Societies of Civil, Mining, Metallurgical, Mechanical and Electrical Engineers, the United Engineering Society and the Engineers' Club herein express to the family of Mr. Carnegie and record their sincere appreciation of the great contributions of Andrew Carnegie to the advancement of engineering and of his friendly assistance in making possible beautiful homes for the engineering societies and the Engineers' Club, thus fostering the spirit of unity in the profession."

Banquet to Be Given Herbert Hoover.—Herbert Hoover expects to arrive in America some time before the middle of September, the exact date to be determined by cable from him. The engineers of America, under the auspices of the American Institute of Mining and Metallurgical Engineers, have decided to express their admiration for Mr. Hoover's services in international affairs during the last five years by inviting him to be their guest at a large dinner in New York, shortly after his arrival. He expects to go directly to his home in California, where he will resume his practice of engineering. An organization has been completed consisting of a general committee appointed by President Winchell of the American Institute of Mining and Metallurgical Engineers, with an executive committee.

Labor Demands Unfavorable to Foreign Trade.—The present disposition of labor organizations to seek relief from the high cost of living through wage increases rather than through increased production leads the National Foreign Trade Council to view with concern the future of our foreign trade in all parts of the world. If the foreign markets of the world in many lines of goods are not to be lost to the United States in the future, two things are obvious: (1) Increased production is a condition precedent to all increases of pay and decreases of working time; (2) the policy of our government must be modeled more along lines which keep maximum production in view than on any system of benefits tending to make labor less self-dependent, or on any theory of decreased hours of work designed fallaciously to provide work for more people but in reality resulting in more pay for the same number of workers.

Electrically Operated Mechanical Servants at New York Electrical Show.—For members of countless households who have been struggling with the servant, and often the servantless, problem, there will be a feature exhibit of both interest and value at the Electrical Exposition of 1919, opening on Sept. 24 in the Grand Central Palace, New York. It will be a model modern home, in the form of a small apartment equipped with electrical machinery and devices which either supplant entirely or greatly lighten the manual labor associated with the operation of a household. These machines and devices are literally as well as figuratively electrical servants. The idea of the model home originated with Arthur Williams, federal food administrator and also head of the Electrical Exposition. Visitors to the show will be surprised to find to what extent the electrical servant home is operated by push-buttons, many of which are within reach of the bedside.

Commonwealth Power Operations.—While the net income of the Commonwealth Power, Railway & Light Company in 1918 showed a decrease of $1,198,721, the increased labor, coal and oil costs and taxes during the same period were as follows: Increased cost of labor, $752,456, or 18.45 per cent; increased cost of coal and oil, $871,915, or 25.11 per cent; increased taxes, $305,445, or 25.32 per cent; total, $1,929,817, or 22.04 per cent. The report to stockholders by Anton G. Hodenpyl, the president, said that the second development on the Manistee River of 22,000 hp., known as the Manistee Junction hydroelectric plant, and the fifth development on the Au Sable River of 12,000 hp., known as the Foote hydroelectric plant, were all completed during the year. "The company in its operations during the year 1918," said Mr. Hodenpyl, "suffered greatly from other than war conditions over which it had no control, such as the extraordinarily severe winter which raised havoc with operating conditions, particularly those of the railways, the very dry season which reduced the water-power output away below normal, and the influenza epidemic in the latter part of the year with its quarantine regulations which affected conditions generally all along the line. Your management, therefore, feels that unless some other conditions arise which are impossible to foresee the net income for the ensuing year should measurably return to that shown prior to 1918."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Injury from Electric Shock.—In action for injury from an electric shock received from defendant's telephone instrument the action of other companies as to character of fuses used in connection with lightning arresters cannot be conclusive. (Joyce vs. Missouri & Kansas Telephone Company, 211 S. W. 900.)

Injury to a Boy When Climbing Electric Light Pole.—Where a power company, under proper authority, maintained a pole and wires near a school, with steps on the pole leading to insufficiently insulated wires, it is not liable, on the ground of nuisance, for injury to a boy coming into contact with the wires in climbing the pole. (Robinson vs. Rockland Light & Power Company, 176, N. Y. S. 281.)

Protection Necessary on High-Voltage Lines.—Maintaining an electric light and power plant transmitting 33,000 volts over wires constructed over a public road without ammeter, circuit breaker or ground detector is negligence little if any less than criminal, and the operators must be held to have anticipated severe shock or death from breaking of wire without shutting off the current. (Abilene Gas & Electric Company vs. Thomas, 211 S. W. 600.)

Modifications of Contracts Between City and Central-Station Company.—A franchise grant by a city council to a public service company to supply water and light to the city and its inhabitants at certain rates becomes, when accepted, a contract between the city and the grantee, the conditions of which are binding, as in any other contract, both on the city and company. Such a contract may be modified by an ordinance, properly passed, raising the water and light rates, when accepted by the company. (Arkansas Light & Power Company vs. Cooley, 211 S. W. 664.)

Invalidating Contract by Public Utilities Act.—The Supreme Court of Illinois has held that the performance of a contract under which a manufacturing corporation transferred a dam to a power company, which agreed for itself and successors to furnish power perpetually to such manufacturer, is not made unlawful by the subsequently enacted public utilities act, as such holding would deprive the manufacturer of property without due process of law, there being nothing in such contract injurious to public welfare, for the protection of which the act was adopted. (Schiller Piano Company vs. Illinois Northern Utilities Company, 123 N. E. 631.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Jacob T. Barron has been appointed superintendent of production of the Public Service Electric Company at Newark, N. J. William B. Hartshorne, as superintendent of the Central Division, succeeds Mr. Barron.

Henry L. Coleman has recently resigned as general manager of the Empire Gas & Electric Company, Geneva, N. Y., to become treasurer and general manager of the Bloss Vein Coal Company, recently organized by Geneva capitalists.

Col. Peter Junkersfeld, who upon returning to civilian work early this year resigned as assistant to the vice-president of the Commonwealth Edison Company to become engineering manager of Stone & Webster, has been awarded the distinguished service

PETER JUNKERSFELD

medal for his work during the war. The *Official Bulletin* of the War Department, issued under the date of July 15, contains the following citation in connection with the award of this medal: "For exceptionally meritorious and distinguished service as associate officer in charge of the building branch of the construction division of the army. By his unremitting industry and energy, sound judgment and knowledge of men he was of the most material assistance in the accomplishment of the construction program of the army. He performed notable service as executive, organizer and administrator."

Frank J. Boehm, who entered the employ of the Union Electric Light & Power Company, St. Louis, nearly ten years ago in a clerical capacity, has been made assistant general manager of the company. Mr. Boehm's advancement began about a year after he became associated with the company, when he was promoted to chief clerk of the billing department. In less than another year he was made statistician; he was promoted to the position of assistant auditor in 1917 and about two years later was advanced to the office of assistant treasurer. Mr. Boehm's broad experience with the company especially fits him for the post of assistant general manager. He has been concerned with inventory and appraisal work, rate research, cost analysis, accounting, statistical presentation, and staff work of like character, and in addition has had charge of such line operations as billing, meter reading, collections, credits, complaints and general bookkeeping.

J. Howard Sturge, superintendent of the Southern Division of the Public Service Electric Company, Newark, N. J., has been appointed superintendent of the Bergen Division, succeeding Mr. Hartshorne, who becomes superintendent of the Central Division.

F. D. Nims, who for some years has been associated with Thomas T. Aldwell, general manager of the Northwestern Power & Manufacturing Company at Port Angeles, Wash., has been apppointed general manager of that company. Mr. Aldwell has resigned to devote his entire time to other interests.

P. K. Condict, vice-president of the International Western Electric Company, has been awarded the fourth order of merit with the Rising Sun through the Japanese Minister of Communications. This honor has been conferred upon Mr. Condict for services rendered in supplying materials necessary for the extension of the telephone system of Japan.

N. S. Franklin, who has been appointed assistant superintendent of the Connecticut Light & Power Company, Waterbury, Conn., was formerly associated with the engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh. Pa. For two years he was commercial power engineer with the Lehigh Navigation Electric Company, and for two years district manager and assistant to the general commercial engineer for the same company, located at Allentown, Pa.

Harry M. Giles, who has been appointed general superintendent of the South Philadelphia works of the Westinghouse Electric & Manufacturing Company, succeeding the late Oscar Otto, killed in an automobile accident last month, has risen from the ranks in the Westinghouse organization. For a number of years past he has been superintendent of marine erection, a position to which he was appointed by H. T. Herr when the Westinghouse electric and machine companies were combined into one organization.

Rudolph Burkhalter, formerly superintendent of the Orange district of the Public Service Electric Company, Newark, N. J., has been made division superintendent of the new division which combines the Orange and Newark districts and will hereafter be known as the Essex division.

H. W. Buck, vice-president of the engineering firm of Vielé, Blackwell & Buck, has been appointed chairman of the public policy committee of the A. I. E. E., succeeding Calvert Townley. Mr. Buck is a past-president of the Institute, having served during the year 1916-1917. On account of his extensive engineering experience and work done along research and experimental lines he is well qualified to direct the Institute in matters affecting its public

H. W. BUCK

policy. Mr. Buck has been a member of the firm of Vielé, Blackwell & Buck since 1908. Previous to that he was electrical engineer of the Niagara Falls Power Company and its allied interests. In coöperation with E. M. Hewlett he developed the suspension insulator system now so widely used on high-tension transmission lines. To his credit also is a patented process for the manufacture of corundum in the electric furnace which was developed and placed in operation at the Niagara Falls plant.

A. H. Kehoe, who has been identified with the United Electric Light & Power Company of New York City for the past eight years, engaged in miscellaneous engineering work, has been appointed superintendent of transmission and distribution of that company. Mr. Kehoe was born in February, 1889. He received his preparatory school training at Bennington, Vt., and was graduated as an electrical engineer from the University of Vermont in 1911. He received college summer training with the Twin State Gas & Electric Company, with the meter and inside construction departments. Mr. Kehoe is a member of the American Institute of Electrical Engineers as well as of the National Electric Light Association.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

WIRE AND CABLE MARKET FIRM WITH DEMANDS HEAVY

Insulated Wire Active with Deliveries Slower—No New Increases in Prices Noted—Manufacturers Ordering Stock

On account of the recent heavy demand for insulated wire, wire manufacturers are behind with their orders and are liable to become swamped if the present conditions continue as they have in the past month. Local stocks of wire are very short, especially in No. 14 rubber-covered and in the smaller sizes of weatherproof. In many cases jobbers find it virtually impossible to fill customers' orders.

A great deal of work has been deferred, but a considerable amount of work is ahead, and orders of considerable volume are being placed. This is especially true in insulated wire for all purposes, although building operations are requiring more than any other line of work. Deliveries on large orders, which usually are quoted at four to six weeks, have slumped from two to three months. All electrical manufacturing plants are demanding more than the average amount of copper and wire.

For four weeks there has been little advance in wire base, and no immediate increase is expected, although wire manufacturers are confident that the market will continue to rise. Rubber-covered is quoted at 30 cents, weatherproof at 29 to 30 cents, while bare wire is offered at 26 to 27 cents. Heater cord is on a 30-cent base, magnet wire is 38 cents for sizes No. 4/0 to No. 8, while annunciator wire, size No. 18, is quoted at 40 cents a pound. Lamp cord, No. 18, is given at $17.50 per 1000 ft. Owing to a shortage of silk supplies, quotations on silk-covered lamp cord cannot be obtained from all producers, and the manufacture of this product has been suspended by some mills. One manufacturer, however, has given a quotation of $58 per 1000 ft.

Copper demands for transmission purposes are light. There is not only a scarcity of large projects, but small installations of branch power lines have been held up and few extensions made, although a considerable amount is planned.

Electrical manufacturing plants are running up to normal production, with one or two exceptions, and the prospects for a good fall season are bright.

JULY ELECTRICAL EXPORTS EXHIBIT DECIDED DROP

Month's Total Amounts to Only $5,996,105, the Lowest Figures That Have Been Recorded for Any Month This Year

Electrical exports took a very decided drop in July. They were lower than those for any preceding month this year, amounting to but $5,996,105. Every item was below the June totals, which month, by the way, was the largest on record.

Exports of generators and switches showed up best in comparison with preceding months. Insulated wire had a fair total of $659,893.

For the first seven months of the year electrical exports amounted to $54,601,574, or at an annual rate of $94,000,000. The totals for the first seven months of the year surpass those for the first seven months of 1918 by a little more than $21,000,000.

The accompanying figures were compiled by the Bureau of Foreign and Domestic Commerce.

	July		Seven Months Ended	
	1918	1919	July, 1918	July, 1919
Batteries	$240,640	$379,021	$1,815,658	$3,576,270
Carbons	100,098	70,991	885,509	927,588
Dynamos or generators	283,407	475,271	1,937,064	3,034,682
Fans	105,823	142,103	651,971	1,137,941
Heating and cooking appliances	64,823	156,745	342,278	970,747
Insulated wire and cable	477,448	659,893	2,989,129	6,249,949
Interior wiring supplies, including fixtures	135,221	160,099	894,854	1,417,294
Arc lamps	524	835	7,188	7,915
Carbon-filament lamps	6,775	4,076	56,617	117,340
Metal filament lamps	309,919	240,719	2,038,848	3,065,531
Magnetos, spark plugs, etc.	151,821	203,809	1,561,298	1,884,191
Meters and measuring instruments	236,019	125,589	1,172,626	1,792,676
Motors	943,006	546,794	4,326,199	6,382,144
Rheostats and controllers	18,730	26,854	137,177	290,957
Switches and accessories	186,086	403,748	1,390,106	2,075,795
Telegraph apparatus, including wireless	30,710	44,892	160,113	560,500
Telephones	296,970	274,387	1,740,661	2,166,446
Transformers	287,459	285,496	1,626,200	2,518,571
All others	1,518,470	1,794,783	9,537,218	16,425,037
Total	$5,393,949	$5,996,105	$33,270,714	$54,601,574

RANGE PRICE ADVANCE DISTURBS NEW ENGLAND

Competition Against Gas Ranges Will Be Difficult on New Basis and Some Utilities Will Not Stock at Present Prices

The recent advances in the prices of nearly all the prominent makes of electric ranges, aggregating 37½ per cent on the list since the middle of July, have aroused considerable interest in New England, and there is a widespread feeling in the trade that if these prices are maintained the retailer is going to have a hard time in making sales in competition with other kinds of ranges. The Hartford (Conn.) Electric Light Company, one of the most active distributers of electric ranges in the New England retail field, has come out flat-footed against the new prices and has announced that it will dispose of its present stock at the old rates and then purchase no more ranges under present price conditions. This decision was reached almost immediately after it became known that range prices were going to advance 25 per cent, but a representative of the ELECTRICAL WORLD who called upon the company a few days ago was informed that the company's action was in no sense hasty, and that it was based upon a thorough study of the reasonable manufacturing and selling costs of ranges of various types and makes. The management of this company feels that there can be no such difference in the cost of producing and marketing the electric range and the corresponding expense of gas-range marketing as appears in the new prices; that the way to popularize electric ranges is through increasing the volume of production and sales and thus ultimately lowering costs to the consumer, and that the new prices cannot be justified to the buying public. The company has had wide experience in the development of electric cooking equipment and has about 300 electric ranges in service on its system. More than half of these were placed this year.

Inquiry among other companies brought out the fact that while few organizations selling ranges regard the new prices as likely to stimulate trade or to enable the existing demand to be maintained, some companies will continue to sell ranges if the public desires them. This is the case with the Pittsfield Electric Company, with the companies operated by C. D. Parker & Company, Boston, and with the Narragansett Electric Lighting Company of Providence. The Edison Electric Illuminating Company of Boston, however, will not stock ranges at the new prices, but will devote its energies to selling its remaining stock purchased before the late advance. At Boston only a nominal advance has been made by the Edison company, about 5 per cent in fact. The Worcester Electric Light Company has not been a large distributer of ranges, but it will not buy for resale at the present prices, according to Fred H. Smith, assistant general manager, who informed the ELECTRICAL WORLD that in his opinion the public will not purchase ranges at the new prices, at least to any extent. Some observers believe that the new prices were established to discourage business on account of the heavy demands on the manufacturers.

METAL MARKET SITUATION

The More Reasonable Stand Taken by Labor Gives a Firmer Tone to Copper

Developments in the labor situation during the past week have had a beneficent effect on the metal market. The apparent decision of labor to desist for a time in its upward boost of wages and to play a little squarer game in the production of more goods in the hours worked than is done at present has given the copper market a little firmer tone. Second-hand dealers are offering their copper at ¼ cent to ⅜ cent higher on this account, rather than continue to cut still lower the prices of producers of the metal.

Copper is held by these producers at 23½ cents a pound for spot and September and 24 cents for October delivery, while the speculators are cutting these prices by 1¼ cent. There is little buying from first hands in a very quiet market, although the seconds are disposing of their holdings in small amounts. Some producers, it seems, have made efforts to stabilize the market by acquiring several lots of cheap copper offered by speculators who were anxious to avoid taking delivery.

The seconds have rather low stocks of cheap copper bought around the 20-cent mark. The producers are satisfied that the market will return in a very few weeks, for, although consumers are pretty well supplied for the present, they can't hold out far into the fall months. When this buying movement does come into its own again it is very probable that prices will advance to some extent.

The lead market is slow, with little metal being offered below producers' price for actual shipments from the smelter. Tin and zinc are quiet and firm.

NEW YORK METAL MARKET PRICES

	Aug. 27	Sept. 2
Copper:	£ s d	£ s d
London, standard spot	98 10 0	101 2 6
	Cents per Pound	Cents per Pound
Prime Lake	23.00	23.12½
Electrolytic	22.00 to 22.25	22.37½
Casting	21.75	22.00
Wire base	26.00	26.00
Lead, trust price	6.00	6.00
Antimony	8.62½	8.62½
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.50	10.50
Spelter, spot	7.90	7.85
Tin	55.50	55.75 to 56.00
Aluminum, 98 to 99 per cent	32.00 to 33.00	32.00 to 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	18.00 to 18.50	18.50 to 19.00
Brass, heavy	10.50 to 11.00	10.50 to 11.00
Brass, light	9.00 to 9.25	9.00 to 9.25
Lead, heavy	5.00 to 5.10	5.00 to 5.10
Zinc, old scrap	5.00 to 5.25	4.75 to 5.00

THE WEEK
IN TRADE

MORE pressing than ever are the demands by local jobbers for wiring material. Stocks are getting short and deliveries are getting back to the familiar war basis. Labor troubles have done considerable to make things worse, although in Chicago, because of the curtailment of building operations, stock conditions are not bad.

Prices, except locally, showed almost no changes during the week. Virtually the entire line of cooking and heating devices is up.

The general labor situation throughout the country looked better on Tuesday than it has since the armistice was signed. Labor appears to be willing to await the results of the administration's efforts to bring down living costs. Increased production is now the national watchword.

NEW YORK

Electrical material used in residence building and for rewiring old houses is moving in considerable volume. Rubber-covered wire in house-lighting sizes is reported low in jobbers' stocks, with some factory production sold to the end of the year. Wiring supplies are increasing in sales, and bells, buzzers and push-buttons have responded to the building call. Household appliances are holding their large sales. Even with new manufacturers continually entering the washer market, deliveries cannot keep up with the demand.

Supplies for industrial building are in more satisfactory shape, and a good volume of contracts is being received for motor installations in both new and old industries.

The New York State Federation of Labor has recommended through its committee a six months' truce with employers, during which there shall be no strikes unless under grave provocation, and a ten-hour product in an eight-hour day. This is New York's answer to date to a national endeavor to increase production and improve labor conditions.

VACUUM CLEANERS.—One manufacturer early last month increased prices $5 to $59.50. Another manufacturer states that he will not change his price before Jan. 1 and hopes to be able to lower it after that time. One machine is to be increased about 12 per cent on Nov. 1 to consumers and on Jan. 1 to dealers. The demand continues high and deliveries are good.

WASHERS.—Sales are good, but deliveries on some makes, although better, are not quick enough to supply the demand. One manufacturer has increased the price on washers with galvanized tub to $135, while those with copper tub hold at $150.

WIRELESS SETS.—Sales continue in good volume for both parts of apparatus and material. Audion detectors sell for $7, but they are not being produced fast enough to meet the demand. Crystal detectors sell for 50 and 75 cents, according to size.

WIRE.—Rubber-covered base is holding at 30 cents, with weatherproof at 30 cents and bare wire 26 to 27 cents. Shortage of silk supplies has caused some manufacturers of silk-covered lamp cord to suspend manufacture of that product. A quotation of $58 per 1000 ft. for ordinary silk cord has been given by one producer still in the game.

FANS.—Stocks among jobbers are at a low stage and rather diversified in sizes. One large retailer is entirely sold out and is ready to call it a season. Another has rather large stocks, and unless a hot September moves them he will not contract for more for the 1920 season.

HEATERS.—One jobber with good stock holding over from last season expects to place no initial order for the

coming season; he will sell at last year's price plus hold-over charges. A prominent retailer has placed two small orders subject to cancellation.

RIGID CONDUIT.—Sales are good and prices firm. Jobbers' prices on ½-in. in carload lots from New York stocks are given at $69.45 for white and $64.35 for black.

BELLS, BUZZERS, ETC.—Sales of house-wiring supplies in the nature of bells, buzzers and push-buttons are in better volume than a few weeks ago. Prices are steady.

CHICAGO

Business among the electrical jobbers is very good, but their sales are almost entirely for work outside Chicago, where the builders' lockout continues. One jobber estimates that his business in this city has fallen off 75 per cent compared with August, 1918. There is growing dissatisfaction on account of poor deliveries from manufacturers and certain lines cannot be obtained at all. Construction in Chicago is at a very low point, the building permits for the week amounting to only about $800,000. St. Louis building permits for the last week total about $1,000,000. At Detroit the Maxwell Motor Company has announced that it will extend its plant to employ 15,000 men. Five hundred homes are also being constructed in Detroit by a million-dollar building corporation. The Oklahoma Gas & Electric Company is extending its lines to serve the towns of Beggs and Mounds, Okla., where electric service is not now available. The Signal Corps of the United States Army in Chicago has called for bids on small odd stocks of electrical materials, including sheet brass, mica, magnet wire, insulating fiber and about 30,000 ft. of lamp cord.

WIRE.—Prices have not changed. The base for rubber-covered is still 30 cents, for weatherproof 29 cents to 30 cents, and for bare, 28 cents. Wire is still very scarce, particularly No. 14, although in all sizes the demand exceeds the delivery.

STEEL-ARMORED CABLE.—There is a fair demand, but no deliveries are being made from the factory.

METERS.—There has been a rather heavy demand for small household meters for out-of-town installations.

SCHEDULE MATERIAL.—Some jobbers report that they cannot get switches and sockets from the manufacturers and that the stocks on hand are practically depleted. One factory is from three to six months behind on deliveries. Prices are firm.

AUTOMOBILE ACCESSORIES.—There has been a rather brisk demand for accessories of all kinds. No price advance has been made, although stocks are very scarce and deliveries are slow.

MOTORS.—Most jobbers have a fairly good stock of all sizes up to 50 hp., and the steady demand in this neighborhood is being well taken care of.

BOSTON

Trade is exceedingly brisk notwithstanding the lull in appliance business as the summer holidays end. Jobbers are hard pressed to fill orders and stocks are subsiding in many lines to levels requiring active steps toward early replenishment. Wiring material is getting scarcer; conduit is in heavy demand for the smaller sizes, and armored flexible conductor is very short in New England. Collections are well maintained. Prices are wavering a little, with weakening tendencies in irons and grills below recent maximum lists. Washing machines, on the other hand, are firmer. So far there is little evidence that prices have greatly affected the purchase of the lighter electric ware. The electric railways are hard pressed but still offer a hand-to-mouth market for electrical supplies. Central stations are going forward conservatively, and the outlook for fall business is most attractive. Building operations showed a decided falling off last week, but it is difficult to handle the work already scheduled, owing to labor troubles and shortages. Electric linemen are on strike for increased pay.

WIRE.—Large quantities of the smaller sizes are moving. Rubber-covered and weatherproof are firm at 30 cents base, bare being quoted around 27 cents. Stocks are fair. No. 14 rubber-covered is selling between $13 and $16 per 1000 ft., according to quantity, and No. 6 rubber-covered from $50 to $61. Weatherproof is firm at $33 per 100 lb. net for over 100 lb. No. 18 annunciator wire brings 52 to 53 cents per pound.

ARMORED FLEXIBLE CONDUCTOR.—Prices are higher, owing to short supply. The demand is very heavy. Single-strip, No. 14, recently brought a bid of $85 per 1000 ft., but the prevailing price is about $75. Building repair jobs are consuming much of this material.

NON-METALLIC FLEXIBLE CONDUIT.—A shortage is reported in the smaller sizes. Four cents per foot is quoted on ¾-in. loom. Business is brisk in this line.

CONDUIT.—Prices are erratic, although the demand is still being fairly met. Labor uncertainties in the steel industry play their part in current fluctuations, it is maintained. Conduit deliveries are none too steady. One-inch black pipe sells for 16.5 cents per foot, net, while 74 cents is asked for 3-in. pipe. Jobbers' stocks are nothing to boast of.

CONDUIT FITTINGS.—Couplings are firmer, the ½-in. size going at 7 cents net, and 3-in. couplings at 66 cents net. Elbows have stiffened to 20 cents net in the ½-in. size and $5.26 in the 3-in.

PORCELAIN FITTINGS.—The demand is heavy and stocks are low in knobs, tubes and cleats. Unglazed cleats are firm at $15 per 1000, net; knobs run from $15 to $16.

MOTORS.—Smaller sizes are in good demand. Prices are steady.

FRICTION TAPE.—Deliveries are a little slow, but not so prolonged as to cause much inconvenience. Two to three weeks are required for quantity shipments. Standard black tape, ¾ in. wide, is selling at 47 cents net per pound in 100-lb. lots. Small orders are being handled with considerable speed.

FUSES.—Prices are steady, with a fair demand. Renewable fuses are much in evidence on order blanks. Lists and discounts show little change from week to week. Discounts range from 40 to 41 per cent on standard packages. Stocks are in excellent condition.

LAMPS—Stocks are in splendid shape for the fall trade. Central-station contracts are beginning to come through, and the demand for lamps has shown considerable increase in the past fortnight. Automobile lamp business has begun to fall off.

WASHING MACHINES.—An advance of $10, to $135 list, was registered Tuesday on a leading make, with galvanized container. Carload deliveries are running from fifteen to thirty days. The demand is extraordinary.

SOCKETS.—Deliveries are quoted at from six weeks to three months for considerable quantities. Discounts range from 20 to 25 per cent on standard packages. Prices run from 30 cents on keyless to 60 cents on pulls. Stocks are hard hit.

HEATING DEVICES.—On Wednesday Simplex irons advanced to $7 and the household range to $140. The week before the new Simplex glow radiator went to $11. This company also announced that, effective Sept. 3, soldering irons would go back to the A list, with approximately the same net cost to the jobber. The A list provides the same discounts for soldering irons as for flatirons.

ATLANTA

Reports from all sections continue optimistic, with the possible exception of isolated instances where labor troubles exist. So far there has been no settlement of the strike on utilities in North Carolina. The buying element is still in the market, and a large volume of material is being moved. Prices on the whole are comparatively steady. Factory shipments as a rule are growing longer.

NON-METALLIC FLEXIBLE CONDUIT.—The demand is heavy. Prevailing shipments from factories are very poor, and as a consequence local stocks are low. Prices are steady. Six cents net per foot is quoted on ½-in. for less than $15 list; in lots, $15 to $60 list, ⅜ in., 6.66 cents; ½ in., 8.88 cents, and ¾ in., 11.10 cents.

RIGID CONDUIT.—Buying pressure is strong and movement heavy. No change in price has been recorded this week. Local stocks are in fair shape, but factory deliveries are slow. Jobbers' prices on black rigid per 100 ft., f.o.b. Atlanta, on lots of 5000 to 10,000 ft. are as follows: ½-in., $7.87; ¾-in., $10.42; 1-in., $15.40; 1¼-in., $20.84.

FLEXIBLE STEEL CONDUIT.—Trade has slowed down some this week. Stocks are low, with shipments from Eastern points poor. Single strip per 100 ft. in coil to 1000 ft. is bringing $4.65 for ⅜-in., $6.98 for ½-in., and $9.30 for ¾-in.

ARMORED STEEL CONDUCTOR.—Stocks are short and factory shipments show no improvement. Prices are inactive. Jobbers' prices on solid duplex conductor No. 14, less than 250 ft., are $110; 250 ft. to 1000 ft., $98.50; No. 14 three-conductor, less than 250 ft., $151.80; coil to 1000 ft., $138; No. 12 duplex, less coil, $148.50; coil to 1000 ft., $135; No. 12 three-conductor, less than 250 ft., $170; coil to 1000 ft., $187.

WIRE.—The market is strong, with weatherproof base holding at 31 cents and rubber-covered at 30 cents. Shipments are getting worse, although local stocks have accumulated. Jobbers' prices per 1000 ft. on solid-conductor, single-braid, rubber-covered, No. 14, are $12; No. 12, $17.53; No. 10, $24.15. On solid-conductor, triple-braid, weatherproof, $35.45 per 100 lb. is quoted for No. 8 in 50-lb. to 100-lb. lots.

WASHING MACHINES.—The call remains insistent, dealers and jobbers experiencing difficulty in supplying current requirements Prices are steady. Stocks are depleted and deliveries from Eastern points bad.

LAMP CORD.—Business is brisk and trade is well sustained. Southeastern stocks are in good shape, but shipments from Eastern points are poor. Cotton-covered in lots of 250 to 1000 ft. is selling from jobbers' stocks at $20.50 per 1000 ft.

DRY BATTERIES.—Transactions are picking up, in the face of low local stocks. Factories are promising from four to six weeks. No change in price has been recorded lately. Jobbers are quoting 35 cents on regular No. 6 and 36 cents on Ignitor No. 6 in barrel lots.

STAMPED STEEL BOXES.—Requirements are growing, but stocks are well filled and ample to take care of current needs. Prices are firm. Jobbers quote 72 cents net on the 4 by 8 by 4 and the 6 by 8 by 4, and 95 cents on the 8 by 10 by 4 in. sizes.

RANGES.—The demand for these has increased considerably within the two weeks. Prices are strong, having advanced 35 per cent in the last two weeks, with prospects for further increases. Deliveries are falling below the standard.

INCLOSED FUSES.—Jobbers report an increasing volume of business with steady prices. Stocks are ample and shipments good. Jobbers' standard-package prices, each net, for the 250-volt sizes, are 12 cents for 3 to 30-amp., 16 cents for 35 to 60-amp., and 41 cents for 65 to 100 amp. The prices for the 600-volt sizes are 18 cents, 28 cents and 69 cents for the above capacities.

SEATTLE—PORTLAND

The past week shows a better feeling in the trade, with a fair volume of orders for maintenance and reconstruction work, although no large orders of any consequence were placed. Several inquiries from lumbering interests for electrical equipments have been received. Retail sales continue excellent, particularly along the lines of washing machines, vacuum cleaners and irons. There has been a noticeable increase in the sale of lamps of standard sizes for residence uses, although the volume to shipyards shows a steady decrease. Collections are good. Very few new credits are being placed. The campaign for farm-lighting units has met with some success especially in central and eastern Washington. While sales have not been heavy, extreme interest is shown and dealers believe a foundation for future business is being laid. Ordering for fall delivery to date has been extremely light because jobbers are overstocked in many lines. Some, however, anticipate shortages along staple lines, due to decreasing production. The labor situation in all parts of the Northwest is in an unsatisfactory condition, with numerous strikes either called or threatened.

From all sides come reports of building activities, especially for private residences and small industrial buildings such as garages, fruit-canning plants, sawmills and shingle plants. An increasing tendency toward electrification of these small plants is noticeable, and during the summer shutdown a considerable number of plants replaced old equipment with electrically driven machinery.

RANGES.—Jobbers and central stations report that the increase in prices has slowed up sales somewhat. However, the volume in suburban towns continues on an even level. Seattle stocks are in good shape.

METERS.—Increased buying is noticed, due to increasing building. Several jobbers in the district are attempting to build up stocks to meet fall demands. Seattle supply exceeds demand and prices are firm.

FUSES.—Renewable types are attracting a lot of attention and increasing sales are anticipated until the winter.

STORAGE BATTERIES.—Increasing auto demand is building up big trade. Sales have exceeded all expectations and some difficulty is experienced in filling orders.

BELLS AND BUZZERS.—Increased buying is noticeable. Stocks are in good shape.

SAN FRANCISCO

The sympathetic strike of the Los Angeles railroad union, supporting the street railroad strike in that city, spread over the entire state. The San Francisco unions are just returning to work, but the Los Angeles district is still defiant. Many carloads of fruit have spoiled as a result, and urgently needed Eastern shipments have been tied up at transfer yards. Retail business in the large Coast cities has been stimulated by the arrival of the Pacific fleet and the throngs of visitors it has attracted. Money was never so plentiful. At least two blanket contracts with the Morris Plan banks have been consummated to care for the dealers' installment business in devices.

FARM PLANTS.—A series of state and county seat fairs has enabled agents to make excellent displays in which valuable missionary work has been accomplished. Sales are good, but deliveries, particularly of direct-connected plants, are indifferent.

MOTORS.—Motors have been steadily advancing in price until they are now 15 per cent on the average above the 1918 figures. Sales of smaller types have been very good, particularly of the fractional sizes. During the last month or so sales of larger types have increased because, notwithstanding spring prophecies, the amount of frozen storage on the mountains has not sufficed to care for the bumper crops of 1919, and emergency pumping installations had to be rushed to the rescue.

ELECTRICAL DEVICES.—The price increases on irons, hollow ware and radiators have caused a flood of orders, and as deliveries, particularly of hollow ware, have been poor, many back orders are being held on the jobbers' files. This increase has awakened dealers to the necessity of anticipating their holiday business, and never before, say jobbers, has there been such an early interest in holiday trade. It will be necessary, too, for with sixty and ninety days common factory delivery, orders placed now will be received none too early.

INSULATORS.—Large order for the Great Western Power Company's equipment, aggregating nearly 60,000 insulators, at an amount of over $200,000, have been placed with the Ohio Brass Company.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

Armored Conductor, Flexible Steel

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft.	5%
	No. 12 Solid
Less than coil	Lis
Coil to 1000 ft.	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$90.00 to $100.00
Coil to 1000 ft.	85.00 to 82.50
	No. 12 Solid
Less than coil	List
Coil to 1000 ft.	5%

Attachment Plugs

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to 20%
Std. pkg.	23% to 36%

Batteries, Dry

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.40	.40
50 to barrel	.36	.37
Barrel lots	.329	.339

Batteries, Dry—*Continued*

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

Conduit, Metallic Flexible

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00 to 109.00	93.00 to 95.00

Conduit, Non-Metallic Flexible

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
⅝	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$35.00	$27.50	$26.50
½-in.—	35.00	30.00	29.00

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
⅜-in.—	$48.00	$27.75	$26.00
½-in.—	$52.00	30.50	28.25

Conduit, Couplings and Elbows, Rigid Iron

Card No. 42

Size, In.	Conduit, List per Foot
⅜	$0.08½
½	.08½
¾	.08½
⅞	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

Conduit, Couplings and Elbows, Rigid Iron—*Continued*

Size, In.	Couplings, List	Elbows, List
⅜	$0.05	$0.19
½	.06	.19
¾	.07	.19
⅞	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	⅜ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	1% to 12.1%	3% to 14.1%
2500 to 5000 lb.	6% to 15.1%	8% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	⅜ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3% to 3.1%	2% to 2.1%
2500 to 5000 lb.	+1% to 5.1%	4% to 7.1%

(For galvanized deduct six points from above discounts.)

Flatirons

NEW YORK

List price	$6.25 to $7.50
Discount	25%

CHICAGO

List price	$6.50 to $7.50
Discount	25% to 30%

Fuses, Inclosed

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40%

Fuse Plugs

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $8.75
1/5 to std. pkg.	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$8.00
1/5 to std. pkg.	7.00

Standard packages, 500. List each, $0.07

Lamps, Mazda or Tungsten

110 to 125 *Volts*

Regular, Clear:	Std. Pkg.	List Each
10 to 50-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.26
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

Lamp Cord

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$28.60–$35.01
Coil to 1000 ft	25.74– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$23.00–$34.00
Coil to 1000 ft.	23.00– 25.00

Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

Outlet Boxes

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	33%–40%	24%–32%
$10.00 to $50.00 list	45%–50%	32%–43%

Pipe Fittings

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

Porcelain Cleats—Unglazed

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$17.85 to $22.40
1/5 to std. pkg	14.70 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$17.85–$18.00
1/5 to std. pkg	14.70– 15.00

Standard pkg., 2200. List per 1000, $20.00 to 21.00

Porcelain Knobs

NEW YORK

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$13.60	$25.00
1/5 to std. pkg	11.50	21.50

Sockets and Receptacles

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20 to list
1/5 std. pkg	List to 10%

Switches, Knife

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

Switches, Snap and Flush

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	23%

Switch Boxes, Sectional Conduit

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 36%

Toasters, Upright

NEW YORK

List price	$6.25 to $7.00
Discount	25%

CHICAGO

List price	$7.50
Discount	25% to 30%

Wire, Annunciator

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.52
No. 18, full spools	.51

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.54 to $0.57
No. 18, full spools	.48 to .51

Wire, Rubber-Covered, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$16.00	$13.00	$13.00
12	21.78	21.78	18.15
10	31.18	27.67	22.64
8	42.12	38.77	31.64
6	61.16	55.60	50.04

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25.00	$14.00	$14.00
12	30.00	19.00	19.00
10	35.77	35.77	30.66
8	42.84	42.84	36.72
6	67.80	67.80	56.50

Wire, Weatherproof

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$34.00
25 to 50 lb	34.00
50 to 100 lb	33.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$33.00
25 to 50 lb	33.00
50 to 100 lb	33.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Automatic Compensator for A.-C. Induction Motors

The automatic compensator which has recently been placed on the market by the Industrial Controller Company of Milwaukee, Wis., is intended for starting and stopping automatically, or at remote points, alternating-current squirrel-cage induction motors of almost any size. The entire stopping and starting of the motor is accomplished by means of remote-control stations, one or more of which can be

MECHANISM INCLOSED BY DUST-PROOF CASING

situated at convenient points, while the compensator itself may be placed on the ceiling near the motor or at any other out-of-the-way location.

A feature of the device is the fact that the period of acceleration may be at any time changed at the remote-control station without the necessity of disturbing or in any way changing the compensator itself. With this compensator the motor, when so desired, may be "inched," as is desirable on some types of machinery or when replacing belts.

A suitable lock is provided at each control station, so that when it is desired that the motor be stopped and kept stopped for any reason whatever it may be locked into the off position, when it can be started neither from the station at which it is locked out nor at any other control station operating the compensator.

The maker claims considerable saving in the installation of the compensator since it may be conveniently located near to the motor, eliminating conduit which might be required were a hand-type compensator used.

The compensator mechanism consists of magnetic contactors operated under oil, which may be easily removed from the oil for convenient inspection or replacement of the contacts since they revolve around an operating shaft. In addition to the magnetic contactors the device contains a suitable auto-transformer and two time-limit overload relays, and the entire compensator, including the relays, is inclosed in a single dust-proof steel casing. Undervoltage protection is provided as the magnetic contactors open upon failure of the voltage, and inverse-time-element relays are provided as standard for overload protection.

Safety Cover for Motor-Controlling Apparatus

Motor-control devices are usually handled either by unskilled labor or by those unfamiliar with electrical machinery, and consequently the necessity for making such apparatus foolproof and safe is apparent. Accordingly the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is making safety inclosing covers for the face plates of motor-controlling rheostats. These can be applied to new apparatus and to old rheostats.

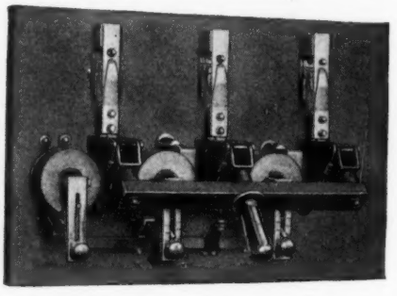
The inclosing cover is a solid sheet-steel box which fits tightly against the rheostat base and is secured by four corner bolts. Pivoted to the cover are two cast-iron arms, one with the operating handle on the outside and one within made with a fork to engage the rheostat handle.

To apply a safety cover to an old rheostat it is necessary only to remove the four nuts on the corner studs of the face plate and replace them with adapter nuts and studs, furnished with the cover. The rheostat handle is also removed and a fiber tube substituted. The cover is then put on so that the fork on the inner arm engages the insulating tube and the four nuts that were on the original rheostat are used to fasten the cover in place. The lead wires from the rheostat are brought through insulating bushings that are held in place by the edge of the cover. While no packing is used to make the cover watertight, it is said to fit so closely that it effectually prevents the entrance of metal chips, sawdust or other material that would cause injury to the rheostat. The cover is grounded through the corner bolts and, being insulated from live parts, is rendered foolproof. It is impossible for an operator accidentally to receive a shock through coming in contact with the working parts of the face plate.

Air Circuit Breakers with Automatic Protection

Overload, underload, shunt-trip, undervoltage and reverse power characteristics are obtained in the type K-2 air circuit breakers recently placed upon the market by the Condit Electrical Manufacturing Company, South Boston, Mass., for use in industrial plants for the control and protection of motors, generators, storage batteries and distribution circuits. They are furnished rear-connected on temporary bases for panel mounting and front-connected on a slate base for installations not requiring the use of a switchboard panel, for installations requiring the breaker to be mounted on walls or pillars, or for cabinet inclosures. The apparatus consists of an upper contact member with auxiliary metal and carbon contacts, studs and nuts, movable contact members comprising the brush with its metal and carbon auxiliary contacts and the operating mechanism, supported by the housing, the tripping coil with its stud, magnetic circuit and calibration plate. The carbon and metal auxiliary contacts are easily renewable and reversible.

A vibration-proof latch holds the breaker normally in closed position, and when released by the tripping coil the moving contact member opens positively and quickly. The magnetic circuit of the trip coils is laminated. This feature is important as it renders overload breakers interchangeable for use on either direct-current or alternating-current circuits. The breaker is easily



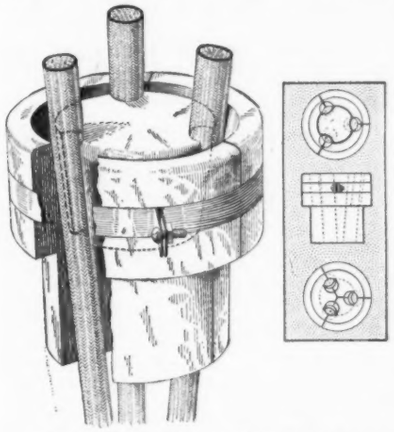
THREE-POLE, REAR-CONNECTED TYPE WITH TWO OVERLOAD COILS

closed by a downward movement of the handle, and the mechanism is so arranged that the brush pressure is properly distributed. Double-pole breakers are arranged for independent closing, but both poles trip simultaneously on overload. Three-pole breakers are arranged with a common handle, caus-

ing all poles to be closed and opened simultaneously. The design of the structural and electrical features conforms to the requirements of the National Board of Fire Underwriters.

Sure-Grip Cable Support

A support for cables is now being marketed by the OZ Cable Support Company of 506 Decatur Street, Brooklyn, N. Y., and is made in several



THE HARDER THE CABLES PULL THE TIGHTER THEY ARE HELD

sizes for 1-in. (2.5 cm.) to 4-in. (10-cm.) conduit and any size or number of wires that can be accommodated therein.

The support is mounted in vertical position in bushings provided at the pull boxes. The holder consists of three parts—the shell, split into different numbers of sections depending upon the number of cables to be held, and containing holes through which the cables are inserted, and a conductor-wedging device the shape of which depends on the number of conductors used. For one conductor it is in the form of a ring and for more conductors it is in the form of a plug placed between the conductors.

The harder the cables pull on the holder the tighter they are wedged against movement. To release the wedge a lever of any kind is placed under the head of the plug and raised. A strap clamps the two halves of the shell together so that they can be separated.

Air-Break Switch with Auxiliary Contact

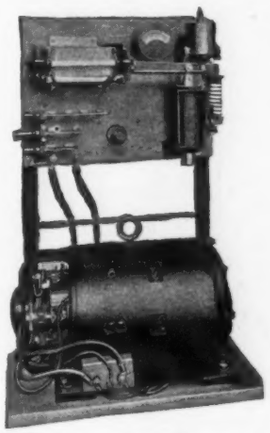
In describing the air-break switch with auxiliary contact recently developed by the George Cutter Company of South Bend, Ind., the statement was made on page 330 of the ELECTRICAL WORLD for Aug. 9 that the main contact of the switch consists of a multiplicity of parallel spring wires, each "sealing" in a "V" notch, etc. This is incorrect, the proper word being "seating." Also the breaking distances and phase spacings of the 44,000, 55,000 and 66,000-volt switches were given incorrectly; they should have been given as 8 ft. (2.4 m.) each.

Plastic Arc Electric Welding Outfit

Constant control of the heat in the weld is a feature of the plastic electric arc-welding unit just brought out by the Wilson Welder & Metal Company of 2 Rector Street, New York City. Practically any metal can be welded with this outfit, it is stated, without the trouble of preheating or annealing.

The set is composed of a dynamotor and current-control panel. The generator is flat-compound-wound and maintains a normal voltage of 35 on either no load or full load. The constant-current controlling panel is small in size, of light weight, simple in operation and high in efficiency, the maker declares. It is made of slate measuring 20 in. by 27 in. (51 cm. by 69 cm.), and on it are mounted a small carbon pile, a compression spring and a solenoid working in opposition to the spring. The solenoid is in series with the arc so that any variation in current causes the solenoid to vary the pressure on the carbon pile, thereby keeping the current constant at the value it is adjusted for.

Three switches on the panel provide an easy means of current adjustment between 25 amp. and 175 amp. The



CONTROL PANEL KEEPS HEAT IN WELD CONSTANT

arrangement of the welding circuit is such that 25 amp. always flows through the solenoid when the main switch is closed, whether the welding current is at the minimum of 25 amp. or the maximum of 175 amp. The rest of the welding current is taken care of in by-pass resistances shunted around the solenoid.

The new outfit can be furnished as a dynamotor unit, with standard motor characteristics as follows: 110 volts, 220 volts, direct current, or 220 volts, 440 volts, 60-cycle, two-phase or three-phase, alternating current; also as a gasoline-driven unit, or it can be furnished without a motor, to be belt-driven. The normal generator speed is 1800 r.p.m. The net weight of the outfit in standard characteristics is 800 lb. (362 kg.) with a direct-current motor, 807 lb. (366 kg.) with alternating-current motor, 1200 lb. (544 kg.) with a gasoline engine, and 550 lb. (249 kg.) as a belted outfit without a motor. These sets can be mounted on a truck for portability, if desired.

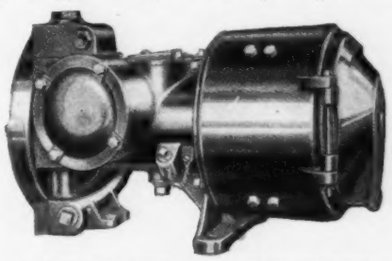
Compact Turbo-Generator for Lighting Service

A number of features are pointed out by the Electric Service Supplies Company, Cambria and Seventeenth Streets, Philadelphia, in the type 532 Keystone turbo-generator, which it is now making with a capacity of 500 watts at 32 volts.

The turbo-generator has an oiling system that automatically lubricates all governor parts as well as all bearings direct, without the use of oil cups, grease cups or oiling rings. An automatic throttle valve is readily and rapidly adjusted and when once "set" maintains its adjustment for a long time. The speed-controlling mechanism of the turbo-generator maintains a practically constant voltage under all operating conditions with changes from no load to full load and with variable steam pressures. Any one of the three main divisions of the machine—namely, the steam compartment, the oil compartment, including the governor and all the ball bearings, and the electric generator compartment—can be singly inspected easily and quickly and disassembled and assembled without disturbing the other compartments. The machine has a simple automatic speed brake which serves to hold the speed within safe limits if for any reason of improper adjustment or accident the turbine tends to overspeed.

The steam turbine of the machine is of the impulse type, and the steam passes twice through the wheel, which is simply and strongly made. The supply of steam used is controlled by a governing mechanism in proportion to the load carried on the electric generator. The throttle valve is controlled by a fly-ball governor which is wholly inclosed within the central oil reservoir.

The generator is direct-connected to the turbine and is of the consequent-pole type. In this consequent-pole de-



PARTS OF TURBO-GENERATOR EASILY ACCESSIBLE FOR INSPECTION

sign four steel poles are provided, the shunt coils being mounted on two of the poles and the series coils on the two remaining poles. This construction gives a four-circuit iron path, with all the advantages incident thereto, while all the internal electrical connections are exactly like a bipolar machine.

Manufacturers' Activities

THE LION ELECTRICAL APPLIANCE COMPANY, INC., New York City, has just announced a capital increase from $25,000 to $100,000.

THE AMERICAN CONDUIT & MANUFACTURING COMPANY, New Kensington, Pa., has increased its capital from $540,000 to $600,000.

THE CLEMENS ELECTRICAL CORPORATION, Buffalo, N. Y., has increased its capital from $100,000 to $250,000.

THE NORTHEAST ELECTRIC COMPANY, Rochester, N. Y., has awarded a contract for the erection of a two-story addition to its electrical goods plant, 86 ft. by 198 ft., on Lyell Avenue, to cost about $60,000.

THE CHICAGO PNEUMATIC TOOL COMPANY announces the removal of its Cincinnati office from the Mercantile Library Building to the Walsh Building, Pearl and Vine Streets, where a service station with a complete stock and repair parts will be maintained.

INCREASE OF REMY EMPLOYEES.—The Remy electric plant of the General Motors Corporation in Anderson, Ind., has increased the number of its employees to 3600. E. F. Creger, works manager, announces that 200 additional men will be employed as soon as houses or apartments are available for their families.

THE MILLER-OWEN ELECTRIC COMPANY, Pittsburgh, Pa., suffered damage by fire recently to the extent of $50,000 to $75,000. Much electrical machinery, including generators and motors, was ruined by fire and water and the building was considerably damaged. The fire supposedly started at a dripping tank containing varnish.

THE LAKEWOOD ENGINEERING COMPANY, Cleveland, Ohio, distributed by airplane the first issue of the *Lakewood Aerial Bulletin*, describing contractors' and industrial equipment. The new paper was dropped by Frank A. Mitchell, general purchasing agent of the company, who was piloted by Lieut. George M. Comey, late of the A. E. F.

THE KELVINATOR CORPORATION, Detroit, Mich., has contracted with the Michigan Light & Consumers' Power Company, with headquarters at Jackson, Mich., to sell and install the Kelvinator domestic refrigerating unit in the following Michigan cities: Jackson, Battle Creek, Kalamazoo, Grand Rapids, Muskegon, Saginaw, Owosso, Pontiac, Manistee and Cadillac.

MONTGOMERY KER has been appointed sales engineer of the Economy Electric Company, with headquarters at Worcester, Mass. Mr. Ker will devote a large share of his time for the present to assisting Peter A. Coghlin, head of that organization, in the handling of engineering and trade problems arising in connection with the expansion of this well-known electrical supply jobber and contractor's business.

W. P. NASER, manager at Chicago for the Trumbull Electric Manufacturing Company, has recently resigned his position to take effect in October, 1919. He has been connected with the Trumbull company for nearly seven years, during which time he opened a branch for the company in San Francisco at the time of the world's fair, and was later promoted to the larger Chicago branch.

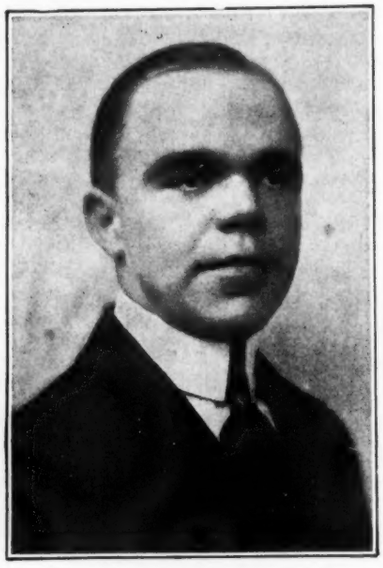
THE AMERICAN STEAM CONVEYOR CORPORATION, Chicago, Ill., announces the appointment of Morton McI. Dukehart & Company as its representatives in Baltimore and the surrounding territory, including all of Maryland and the District of Columbia and a few counties in Pennsylvania, Delaware, West Virginia and Virginia. This concern consists of Mr. Dukehart, and E. S. Denise, both power-plant and sales engineers.

DAVENPORT FIRMS MOVE.—Four electrical firms in Davenport, Ia., which have been doing business in the Electrical Building, were due to move Sept. 1 to other locations as the structure will be torn down. The Electrical Construction & Machinery Company, the Island City Fixture Company and the Marron Manufacturing Company will remove to the Oil Building, on Second Avenue. The H. E. Gelhardt Company, wholesale dealer in electrical wires and other electrical supplies, will also move to a new location.

THE NATIONAL CONDUIT & CABLE COMPANY has issued an estimated six months' income account for the period ended June 30, 1919, showing net sales of $4,760,150 and costs and expenses of $5,1 156,964, making the loss from operation $396,814. The account also shows that this was reduced by $62,066, which was itemized as other income, while the total loss for the period after the addition of taxes, interest, depreciation and other charges totaled $643,296. This compares with a loss of $394,468 for the corresponding six months of 1918.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., announces the following changes and appointments: W. H. Garrett has been appointed manager of the electrical as well as the steam contract division of the power sales department; G. T. Gilchrist of the research engineering department becomes acting manager of the porcelain section, with headquarters at Derry, Pa.; K. B. Hunter, manager of the engine and pump department of the Pittsburgh office of the Fairbank-Morse Company, has resigned to become connected with the Cincinnati office of the Westinghouse company. J. C. Van Norman, manager of the electrical contract division of power sales, has been transferred to the Atlantic district office.

L. M. DECKER, who was assistant sales manager of the Cushman Motor Works, Lincon, Neb., manufacturers of farm-lighting plants, has been appointed sales manager of the company to succeed N. H. Williams, resigned.



L. M. DECKER

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm located in the Red Sea district (No. 30,424) desires to receive catalogs of telephones, telephone wires and equipment.

A Scandinavian firm (No. 30,444) desires to secure an agency for the sale of electrical appliances. Correspondence may be in English.

A company in Belgium (No. 30,425) seeks the representation of a firm manufacturing electric motors and accessories. Correspondence should be in French.

A merchant in Algeria (No. 30,430) wishes to secure an agency for the sale of electrical equipment, motors and accessories, and generators. Quotations should be given c.i.f. Algeria. Correspondence should be in French.

A firm in New Zealand (No. 30,448) desires to secure an agency for the sale of electrical appliances and telephone (manual and automatic) accessories. Quotations should be given c.i.f. New Zealand or f.o.b. port of shipment. Terms, cash against documents.

Trade Publications

METER BOX.—The Safety Meter Box Company of Cleveland has issued a circular describing and illustrating the use of its safety meter box.

WIRING SPECIALTIES.—This is a title of a new 1919 catalog recently distributed by the Arrow Electric Company of Hartford, Conn. Prices are given in this bulletin.

WIRE-STRINGING FIXTURE.—Nail-assembled knobs are described and illustrated in the circular being distributed by the R. Thomas & Son Company, East Liverpool, Ohio.

RADIO-TELEGRAPH AND ELECTRICAL LABORATORY APPARATUS.—The Clapp-Eastham Company, 139 Main Street, Cambridge, Mass. has issued a catalog on the above subject.

TRAILER TRUCKS.—The R. W. Whitehurst Manufacturing Corporation of Norfolk, Va., has issued an illustrated circular about its trailer trucks for use with industrial tractors.

REINFORCED - CONCRETE POLE BASES.—W. Roy McCanne, 1050 University Avenue, Rochester, N. Y., is circulating an illustrated folder telling about reinforced concrete pole bases.

SMALL MOTORS AND GENERATORS.—The Westinghoushe Electric & Manufacturing Company of East Pittsburgh, Pa., has issued catalog No. 38, a sixty-four-page illustrated publication which describes the small motors and generators made by this company.

INSULATORS.—Insulator design, testing and descriptions of the parts and use of all types of low-tension and high-tension insulators are given in a comprehensive illustrated booklet recently issued by the Locke Insulator Manufacturing Company of Victor, N. Y.

New Incorporations

THE STUART (KY.) PUBLIC SERVICE COMPANY has been incorporated with a capital stock of $50,000. The officers are: George R. Hilty, president, and J. A. Phillips, secretary.

THE RELIABLE SPARK PLUG COMPANY of Dayton, Ohio, has been incorporated by E. E. Kumler and others to manufacture a newly patented spark plug. The company is capitalized at $10,000.

THE MIGHTY MAUFACTURING COMPANY of Buffalo, N. Y., has been incorporated with a capital stock of $50,000 to manufacture electrical devices, etc. The incorporateors are G. N. Chaltas, E. Pappas and E. L. Crabb.

THE CHARLOTTESVILLE (IND.) ELECTRIC LIGHT, HEAT & POWER COMPANY has been incorporated with a capital stock of $10,000 by Winfield S. Lane, Allen Hill, Sherman Smith, William Elb and Frank Craft.

THE ELECTRIC CARPET WASHER COMPANY of Milwaukee, Wis., has been incorporated by J. A. Barry, E. G. Patek and John F. Bluemm. The company is capitalized at $25,000 and proposes to manufacture special motor-driven machines.

THE SOUTHERN ELECTRIC COMPANY, 636 King Street, Charleston, S. C., has been incorporated with a capital stock of $6,000 to do general electrical contracting and repair work, including storage battery charging, armature winding, etc. J. H. Disher is president and E. L. Bull is vice-president and manager.

THE BATTERY GUARD MANUFACTURING COMPANY of Los Angeles, Cal., has been incorporated by J. F. Andres, 1151 West Fifty-second Street, Los Angeles, and Paul P. Jones and A. S. Churton, 410 West Elk Avenue, Glendale, Cal. The company is capitalized at $75,000 and proposes to manufacture storage batteries and thermostatic controls.

THE EXCELSIOR ELECTRIC DAIRY MACHINERY, LTD., of Toronto, Ont., Can., has been incorporated with a capital stock of $100,000 to manufacture electric motors, electric machinery, dairy machinery, fine tools, etc. The incorporators are: Lewis T. Rutledge, 320 Concord Avenue; William W. Baldwin, Alfred N. Morine, 156 Yonge Street, and others.

New England States

LUBEC, ME.—Arrangements are being made for the installation of a municipal electric light plant in Lubec for which an appropriation of $25,000 has been made.

MILFORD, N. H.—A portion of the engine and boiler plant at the Page & Cote mills was recently destroyed by fire.

CAMBRIDGE, MASS.—Plans are being prepared by John P. Squire & Company, 165 Gore Street, for the erection of a cold storage plant, to cost about $200,000.

PROVIDENCE, R. I.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 26 for remodeling the United States custom house and post office at Providence. For details see Searchlight Section.

Middle Atlantic States

BROOKLYN, N. Y.—Receivers' certificates aggregating $18,000,000 have been sold by the Brooklyn Rapid Transit Company. Of the proceeds not less than $13,000,000 or more than $15,000,000 will be used for extensions to its power facilities, including the erection of power stations, extensions to present plants, improvements, etc. Lindley M. Garrison is receiver.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Sept. 10 for an artesian well for additional water supply at North Colony power plant, Central Islip (N. Y.) Hospital. F. L. Pilcher, Capitol, Albany, is state architect.

NEW YORK, N. Y.—The American Bosch Magneto Corporation, 223 West Forty-sixth Street, has acquired a site on Sixtieth Street, near Broadway, on which it proposes to erect a ten-story building and salesroom, to cost about $700,000.

NEW YORK, N. Y.—Plans are being prepared by Charles Cory & Company, 290 Hudson Street, for an addition, 140 ft. by 175 ft., to its plant, to cost about $200,000. The company manufactures ships, engine bells, electrically operated apparatus, etc. Russell G. Cory, 39 Cortlandt Street, is engineer.

ROCHESTER, N. Y.—Orders have been placed by the Rochester Railway & Light Company for 3 miles of underground cable to be placed in conduits on State Street, Ravine Avenue and Hastings Avenue, to a point above the lower falls where it will cross the river to the water-power station No. 5, connecting it with the steam-driven power station at Brown's Race.

SYRACUSE, N. Y.—The Dyneto Electric Company has entered into a contract with R. M. Owen & Company, manufacturers of the Owen magnetic automobile, to furnish all the electric lighting equipment on the Owen cars. Another new building will be erected by the Dyneto Company to enable it to carry out the contract.

BLOOMINGDALE, N. J.—The Borough Council has voted to install new arc lamps on Carmonton Road, the service to be furnished by the municipal electric light plant at Butler.

UNION, N. J.—Bids will be received by the board of education of the town of Union, Hudson County, until Sept. 18 for mechanical equipment for new school building to be erected in Union, separate bids to be submitted on the following items: Heating and ventilating, plumbing, electrical work, vacuum cleaner. Plans and specifications may be obtained from the secretary of the board (office in high school), upon payment of $25, of which $15 will be refunded upon return of same.

BATH, PA.—The Republic Engineers, Inc., consulting and construction engineers, 60 Broadway, New York, N. Y., have been engaged by the Pennsylvania Cement Company in connection with the proposed installation of waste heat boiler and power plant at its local cement mill.

EMAUS, PA.—The Borough Council is considering the establishment of a municipal electric light plant in Emaus.

HERSHEY, PA.—Arrangements are being made by the Hershey Chocolate Company for equipping its railroad for electrical operation in connection with other improvements and extensions. The cost of the entire work is estimated at more than $5,000,000.

MONT ALTO, PA.—Bids will be received by Edward Martin, commissioner of health, Harrisburg, until Sept. 17, for additions to heating plant, laundry building, etc., at State Sanatorium, Mont Alto, as follows: (1) Additions to heating plant building at main camp; (2) constructing heating plant at hospital; (3) constructing laundry building (no laundry machinery); (3a) heating laundry building; (3b) plumbing laundry building; (3c) electric wiring laundry building. Plans and specifications may be obtained at the office of the engineering division, State Health Department, 22 South Third Street, Harrisburg, upon deposit of $25.

OIL CITY, PA.—Work has been started on improvements to the system of the Citizens' Traction Company, involving an expenditure of about $300,000, which will include an addition to the power house, installation of a 5000-kw. generator, two 500-hp. boilers, new stokers and ash-handling apparatus. Two transmission lines to Franklin over two separate routes are also to be erected.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 9 for furnishing 50 lamp poles under Schedule 4411.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company has applied for permission to build an underground conduit system in the vicinity of Montebello Terrace to its Hamilton exchange.

BALTIMORE, MD.—Arrangements have been made for the construction of a power plant, to cost about $86,000, in connection with the proposed water-front improvements planned by local interests, to cost more than $5,000,000.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company is planning to double the output of its Rivesville plant and to extend its high-tension transmission lines to Meriden, Grafton and Rivesville.

FAIRMONT, W. VA.—Plans are being prepared by the West Virginia Metal Products Company for its proposed brass and copper works, to cost about $1,000,000. The cost of the initial unit, including equipment, is estimated at about $300,000. J. E. Watson is president.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 17, under Specification 4017, for the installation of a 1000-kw. turbo-generator, to cost about $17,000.

WASHINGTON, D. C.—Bids will be received by the Commissioner of Indian Affairs, Department of Interior, Washington, D. C., until Sept. 18 for installing sewerage system, water service lines and electric lighting plant at Standing Rock School, North Dakota.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, until Sept. 9 for furnishing under Schedule 4420, at Philadelphia, Pa., Mare Island, Cal., and Puget Sound, Wash., 850 storage-battery-testing sets.

WASHINGTON, D. C.—Bids will be received by the Machinery and Engineering Materials Division, Munitions Building, Washington, D. C., until Sept. 10, under Circular 36, for furnishing 400 cable boxes and 150 wrought galvanized-iron pipes, each 4 ft. 4 in. long.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Sept. 16, Brooklyn, N. Y., Schedule 4431—telephone and cable apparatus. Until Sept. 12, Boston, Mass., Schedule 4440—thirty-five reversible air compound motors; Norfolk, Va., Schedule 4471—miscellaneous copper tubing; Mare Island, Cal., Schedule 4477—two condensers. Until Sept. 23, Mare Island, Schedule 4454—100 gal. of insulating varnish. Washington, D. C., Schedule 4460—electrical equipment; Brooklyn, N. Y., Schedule 4461—two dynamo meters. Until Sept. 30, Schedule 4457—Tacoma, Wash., Quincy, Mass., Philadelphia, Pa., and Boston, Mass., laundry equipment.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central States

DETROIT, MICH.—The Detroit Edison Company has been granted a permit for the erection of a power house, to cost $150,000, at its plant adjoining Fort Wayne.

DETROIT, MICH.—Tentative plans are being prepared by A. Kahn, architect, Marquette Building, for construction of building for police headquarters for Police Department, to cost about $300,000.

LANSING, MICH.—Bonds to the amount of $1,321,000 have been voted. Of the proceeds, $650,000 will be used for municipal water and light plants, isolation hospital $100,000, and addition to cemetery, $38,000.

MARYSVILLE, MICH.—The Detroit (Mich.) Edison Company, it is reported, is contemplating the construction of a power plant in Marysville on St. Clair River and Bunce Creek. The equipment will include a 30,000-kw. generating unit.

THREE RIVERS, MICH.—The Eddy Paper Company is planning to erect an electric power house in connection with a paper mill. The cost of the entire work is estimated at about $1,000,000.

CLEVELAND, OHIO.—The Drew Electric Manufacturing Company contemplates the construction of a new plant, to cost about $35,000.

CLEVELAND, OHIO.—Plans have been prepared by the Martin Bariss Company, 2048 West Third Street, for the erection of a sawmill and power house, to cost with equipment about $100,000. George S. Reder, Century Building, is architect.

CLEVELAND, OHIO.—Bids will be received by the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until Sept. 12 for single-phase transformers. Specifications may be obtained upon application to Room 204, City Hall.

DAYTON, OHIO.—The National Cash Register Company is planning extensions to its plant, to cost about $1,000,000.

HAMILTON, OHIO.—The City Council has appropriated $15,000 for extensions to the municipal electric light plant.

SPRINGFIELD, OHIO.—Contract has been awarded by the James Leffel Company for the installation of power, heating, lighting and sanitation systems at its new plant on East Street to the Utilities Engineering Company, at a cost of about $125,000. The cost of the power plant is estimated at $20,000 and that of the power and lighting distribution systems at $10,000.

OWENSBORO, KY.—Plans have been prepared by the Kentucky Electric Lamp Company for the construction of a new plant, 60 ft. by 100 ft., three stories, increasing its output from about 3000 to 8850 lamps daily.

ROACHDALE, IND.—The capital stock of the Roachdale Electric Company has been increased from $50,000 to $100,000.

SOUTH BEND, IND.—The Public Service Commission has granted the Northern Indiana Gas & Electric Company permission to issue $1,067,000 in notes, the proceeds to be used for extensions and improvements to its properties in South Bend, Fort Wayne, Lafayette, Logansport, Michigan City, Hammond and Peru.

WEST BADEN, IND.—The capital stock of the West Baden & French Lick Water, Light, Heat & Power Company has been increased from $100,000 to $300,000.

CHICAGO, ILL.—Plans have been prepared for the erection of a large plant at Thirty-first Street and Kedzie Street for the Cook County Paper Stock Company, to cost about $1,000,000.

CHICAGO, ILL.—The Federal Electric Company has acquired a site at the corner of Lake and Des Plaines Streets on which it proposes to erect a new plant. The company manufactures electrical equipment.

CHICAGO, ILL.—The Wilson-Jones Loose Leaf Company has purchased a site on which it proposes to erect a factory, to cost about $400,000. The plans provide for a power house. For further information address general manager, 3021 Carroll Avenue.

DEER CREEK, ILL.—The Deer Creek Power & Light Company has increased its capital stock from $15,000 to $25,000.

DWIGHT, ILL.—The installation of a new street-lighting system in Dwight is under consideration. The service is furnished by the Public Service Company of Northern Illinois from the Joliet and Blue Island stations.

PEORIA, ILL.—A new factory will be erected by the Western Structural & Machine Works, to cost about $500,000.

FOND DU LAC, WIS.—Plans are being prepared by M. Tullgren & Sons, architects, First National Bank Building, Milwaukee, for a creamery and power house for the Galloway-West Company, 24 West Division Street.

JANESVILLE, WIS.—Van Ryn & DeGeleke, architects, Caswell Block, Milwaukee, have been engaged to prepare plans for a high and vocational training school, with a separate boiler and power house, for which bids, it is understood, will be asked about Sept. 10.

MILWAUKEE, WIS.—Plans have been completed for the erection of a power house and garage at Thirty-fifth and National Avenues for the Johnston Company, to cost about $65,000. Bids, it is understood, are being received by the company.

PORT WASHINGTON, WIS.—Plans are being prepared by Douglas Cahill, engineer, Gross Building, Milwaukee, for an addition to the municipal electric power plant, to cost about $30,000.

WAUPACA, WIS.—Contracts, it is reported, will soon be awarded for the construction of a hydroelectric power plant in Waupaca. For further information address F. H. Josslyn, general manager, Algoma Building, Oshkosh.

ATKINS, IOWA.—The installation of an electric lighting system in Atkins is under consideration. It has not yet been decided whether to install a plant here or make connections with the system of the Iowa Railway & Light Company.

STORY CITY, IOWA.—Contract for construction of the proposed municipal electric light plant has been awarded to the David G. Feshut Company, at about $36,000.

TERRIL, IOWA.—The installation of an electric lighting system in Terril is under consideration.

TRAER, IOWA.—Negotiations have been completed whereby the city of Traer will take over the local system of the Iowa Railway & Light Company at $33,000. The plant will be completely overhauled and new machinery installed. Electricity will be supplied by the Cedar Rapids company while the plant is being reconstructed.

INDEPENDENCE, MO.—Extensions to the municipal power station and the installation of a new generating unit are under consideration. An issue of $50,000 in bonds has been recommended to carry out the work.

KANSAS CITY, MO.—The City Ice & Storage Company is planning to build an ice plant, to cost about $300,000.

PALMYRA, MO.—Bonds to the amount of $10,000 have been authorized for improvements to the municipal electric light and power plant.

DELL RAPIDS, S. D.—Bids will be received by the city of Dell Rapids until Sept. 9 for the installation of an ornamental street-lighting system, consisting of 130 cast-iron posts with lamps, sockets and globes, cut-outs, two switchboards, meters, transformers and steel-tape lead-covered cables. L. K. Larson is Mayor.

AUBURN, NEB.—A petition has been presented to the Council asking that an election be held to vote on a bond issue to provide funds for extension to the municipal electric light plant. It is proposed to equip the plant to supply electricity for commercial purposes.

OMAHA, NEB.—The Union Power & Light Company has been granted permission to issue $119 000 in capital stock.

CHANUTE, KAN.—Bonds to the amount of $250,000 have been voted for extensions to the municipal electric light plant and waterworks system.

HANOVER, KAN.—Plans have been prepared by Black & Veatch, engineers, Inter-State Building, Kansas City, Mo., for improvements to the municipal electric light plant.

HANOVER, KAN.—Plans are under consideration to build a power dam on Little Blue River in Hanover, to cost about $150,000. The proposed plant, it is reported, will supply electricity to the municipal electric light plant and waterworks system and also to other towns in this vicinity.

HAZLETON, KAN.—At an election held recently the proposal to issue bonds for the installation of an electric lighting system was carried.

HUDSON, KAN.—Plans are being prepared by W. B. Rollins & Company, engineers, Railway Building, Kansas City, Mo., for the erection of an electric transmission line for the proposed municipal electric lighting system. The cost is estimated at about $15,000.

Southern States

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 17, under Specification 4011, for the installation of a 2500-kva. turbo-generator at the local navy yard, to cost about $50,000.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 10, for installing mechanical stokers in central power plant at the local navy yard, to cost about $11,000. (Specification 4010). A deposit of $10 will be required for plans.

GAFFNEY, S. C.—Arrangements are being made for the installation of a new lighting system in Gaffney. L. V. Gaffney is superintendent.

ARLINGTON, GA.—The Baker County Power Company is planning to construct a hydroelectric power plant on Natchanny Creek, in Baker County, to cost, with transmission system, about $640,000. W. E. Saunders is president.

BAINBRIDGE, GA.—The Southwest Georgia Power Company has applied for a charter for the purpose of building an electric power plant on Spring Creek in Decatur County. The company will be capitalized at $150,000. I. F. Murphy and Lewis B. Rumph of Macon County and E. J. Perry and J. M. Simmons of Decatur County are interested in the project.

ST. AUGUSTINE, FLA.—The St. Augustine Public Service Corporation contemplates the construction of an electric railway from St. Augustine to Jacksonville. T. R. Osmond of St. Augustine is interested.

ROCK RUN, ALA.—The Bass Foundry & Machine Company of Fort Wayne, Ind., contemplates the construction of a new plant near its branch works at Rock Run, for the manufacture of boilers, engines, railway axles, etc., to cost with equipment about $250,000.

SELMA, ALA.—The property of the Selma Lighting Company has been purchased by the Alabama Power Company of Birmingham.

NATCHEZ, MISS.—The city of Natchez is considering the installation of an ornamental street-lighting system. The present plans provide for 100 ornamental standards, equipped with one 400-cp. nitrogen lamp, in the business district and 112 on suspended fixtures, each fixture to be mounted with one 60-cp. nitrogen lamp; also 70 (more or less) 100-cp. nitrogen lamps to be erected on brackets. The Southern Railway & Light Company has the contract for street lighting. Frank J. Duffy is president of the company.

STARKVILLE, MISS.—Bonds to the amount of $55,000 have been authorized for improvements to the electric light, water and sewer systems.

COTTER, ARK.—Surveys are being made by the Dixie Power Company on 50 miles of the White River for the purpose of deciding on plans for hydroelectric development. The present plans provide for the construction of a power dam 75 ft. by 12 ft. high, 1500 ft. long, to develop from 40,000 hp. to 100,000 hp. It is proposed to form a lake 50 miles long, a storage dam, and also two dams to regulate the flow of the White River. H. A. Allen of Chicago, Ill., is engineer. Walter V. Powell is president.

DELIGHT, ARK.—J. F. Rhyne is reported to be interested in a project to install an electric light plant in Delight.

OKOLONA, ARK.—The installation of an electric light plant in Okolona is under consideration. J. F. Rhyne of Delight is reported interested.

EUFAULA, OKLA.—Bonds to the amount of $25,000 have been authorized for the installation of an electric lighting system and waterworks. Bids, it is understood, will soon be asked for the work.

COMANCHE, OKLA.—Plans are being prepared for extensions and improvements to the municipal electric light plant, to cost about $10,000.

STROUD, OKLA.—Improvements to the municipal electric light plant and waterworks system are under consideration.

SULPHUR, OKLA.—The Sulphur Ice, Light & Power Company is contemplating the purchase of new machinery for its plant, to cost about $30,000.

TISHOMINGO, OKLA.—Bids will be received by the town of Tishomingo until Sept. 18 for the construction of a complete electric lighting plant and distribution system, consisting of a power house, equipped with two 75-kva. generators, directly connected to semi-Diesel oil engines, switchboards, 15,000 lb. copper wire, 400 poles, line material, etc. Plans and specifications can be secured from Johnson & Benham, consulting engineers, Firestone Building, Kansas City, Mo., upon payment of $5, or may be seen at the office of the town clerk, Tishomingo. C. H. Holland is town clerk.

ALBANY, TEX.—The City Council is considering the installation of a municipal electric light and ice plant, to cost about $40,000.

CANTON, TEX.—The Hercules Power Company, recently organized, contemplates the construction of an electric plant in connection with the development of lignite mines. The company proposes to manufacture gas for fuel as a by-product. A. B. Saling is manager.

FORT WORTH, TEX.—The construction of electric railways between Fort Worth and Denton and between Fort Worth and Irving, each 30 miles long, is under consideration by E. P. Turner and associates. Financial arrangements for construction of the roads, it is stated, have been made and franchises have been granted.

WICHITA FALLS, TEX.—Extensions are being made to the power plant of the Wichita Falls Electric Company, including the installation of a 5000-hp. turbine engine, etc. The company has erected an electric transmission line into the Burkburnett oil field, including the Northwest extension pool, to supply electricity for the oil wells and pumping plants.

Pacific and Mountain States

PORTLAND, ORE.—The property of the Gambrinus Brewery has been taken over by the Terminal Ice & Cold Storage Company, which will operate it as a cold-storage plant. The plant will be equipped of electrical operation and some new equipment installed.

FRESNO, CAL.—The San Joaquin Light & Power Company has applied to the State Railroad Commission for permission to issue $1,250,000 in bonds, the proceeds to be used for extension to its service in the San Joaquin Valley.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 1 (change of date), for installing electric lighting and power systems at the local navy yard, to cost about $25,000, (Specification 3982). A deposit of $10 will be required for plans.

ROOSEVELT, ARIZ.—The Salt River Valley Water Users' Association of Phoenix is planning to erect a 5000-kw. steam-driven electric generating plant to furnish power to operate about sixty pumps, which will be used to lower underground level. C. A. Van der Verr is secretary.

BILLINGS, MONT.—The Montana Power Company has begun work on the erection of a high-tension transmission line from Harlowton to Billings and Roundup. F. M. Kerrof Butte is vice-president and general manager of the company.

DEMING, N. M.—The Elephant Butte (N. M.) Power Company is planning to erect an electric transmission line from the dam to Deming, to cost about $224,000.

Canada

VANCOUVER, B. C.—A permit has been granted to the Electrical Manufacturing Company for the erection of a new plant on Granville Island, to cost about $5,000.

PORT COLBORNE, ONT.—The government elevator at Port Colborne was recently destroyed by fire, causing a loss of about $1,000,000. It had a capacity of 2,000,000 bushels and was operated by electricity. Work on rebuilding will start at once. J. A. Jamieson is architect.

TORONTO, ONT.—The construction of a machinery hall and manufacturers' building in Exhibition Park, to cost about $1,500,000, is under consideration by the Canadian National Exhibition, 36 King Street.

MONTREAL, QUE.—The general contract for construction of a power house for the Sisters' Congregation of Notre Dame has been awarded to Ernest Cormier, 10 Cathcart Street. New equipment, including one 5-kw. generator, two steam engines, storage batteries, boilers, pumps and electric motors, will be purchased.

Miscellaneous

PEARL HARBOR, HAWAII.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 10 for construction of torpedo track, electric trolley and hoist and gyro, to cost about $25,000, at the local navy yard. A deposit of $10 will be required for plans.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Sept. 11, under Circular 1302, for pipe fittings, hoppers, valves, cable end bells, lamp changers, electrical supplies, conduit, safety conduit seals, etc. Bids will also be received until Sept. 30, under Circular 1303, for furnishing steel, copper, iron or steel pipe, boiler tubes, etc. Further information may be obtained at the above office.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City. Annual meeting, Oct. 6-10.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS UTILITIES ASSOCIATION. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass. Annual meeting, New London, Conn., Sept. 15-18.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, St. Louis, Mo., Sept. 22-26.

ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS OF ONTARIO. Secretary, R. A. Clement, 190 University Ave., Toronto, Ont., Can.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St., East, Toronto, Ont.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, V. F. Kennedy, 900 15th St., Denver, Col. Annual meeting, Glenwood Springs, Sept. 18-20.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 110 West 40th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 38th St., New York City. Annual meeting, New York City, Oct. 9.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill. Annual convention, Chicago, Ill., Oct. 23 and 24.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Chicago, Oct. 21-24.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Chicago, Sept. 23-26.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), J. F. Strickland, Dallas, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary and treasurer, Meyer Barnest, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary, E. S. Meyers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania Tennessee and Wisconsin. Annual convention, Baltimore, Md., Oct. 6, 1920.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass. Annual meeting, Springfield, Mass., Oct. 13 and 14.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, New London, Conn., Sept. 22, 23, 24.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Seattle, Wash., Sept. 10-13.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 171 Second St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 4171 Beaufort Avenue, Woodlawn, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual convention, Asheville, N. C., Sept. 17-19.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

TECHNICAL AND HYDROELECTRIC SECTION OF THE N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

(Issued Augst 12, 1919)

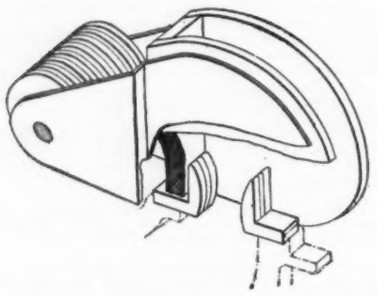
1,313,124. ELECTRODE; Mark Sheold, Chicago, Ill. App. filed Oct. 21, 1918. Interlocking members.

1,313,126. ELECTRIC FURNACE ELECTRODE; Mark Sheold, Chicago, Ill. App. filed Oct. 21, 1918. Vertical type.

1,313,129. EXPLOSIVE SHELL; William M. Smith, Evansville, Ind. App. filed Aug. 29, 1917.

1,313,139. LAMP SOCKET; Don N. Thompson, Syracuse, N. Y. App. filed Nov. 2, 1917. Arcing eliminated.

1,313,176. ELECTROMAGNETIC BLOW-OUT DEVICE; Clarence T. Evans, Milwaukee, Wis. App. filed Nov. 23, 1916. Normal curvature of lines of force reversed.



1,313,176 — Electromagnetic Blow-Out Device

1,313,187. METHOD OF AND MEANS FOR AMPLIFYING ELECTRICAL VARIATIONS; Albert W. Hull, Schenectady, N. Y. App. filed Nov. 8, 1915.

1,313,188. MEANS FOR PRODUCING ALTERNATING CURRENTS; Albert W. Hull, Schenectady, N. Y. App. filed Nov. 8. 1915. Lag in action avoided.

(Issued Aug. 19, 1919)

1,313,246. ELECTROLYTIC PROCESS AND ANODE; Frank L. Antisell, Perth Amboy, N. J. App. filed Aug. 17, 1918. Secondary reactions decreased.

1,313,249. SAFETY DEVICE FOR USE IN REPAIRING AND RENEWING INSULATORS OF HIGH-VOLTAGE TRANSMISSION LINES; William S. Bellows, Benton Harbor, Mich. App. filed April 10, 1918. Tie wires eliminated.

1,313,258. ELECTRIC HEATER; James H. Carmean and Samuel M. Carmean, Kansas City, Mo. App. filed Aug. 5, 1918. Motor-driven fan effects a circulation and heating of air.

1,313,272. DYNAMO-ELECTRIC MACHINE AND METHOD OF AND APPARATUS FOR CONTROLLING THE OUTPUT THEREOF; Alfred H. Darker, Blackheath, Eng. App. filed Jan. 20, 1916. Applicable to electric train lighting, heating and ventilating systems, etc.

1,313,274. MEANS FOR REDUCING ORES; Diogo Dias de Barros, Sao Paulo, Brazil. App. filed Dec. 27, 1917. Continuous circulation.

1,313,288. ELECTRIC FUSE PLUG; Joseph Glatz, Philadelphia, Pa. App. filed Feb. 8, 1919. Special means for renewing fuse.

1,313,295. INKING MECHANISM FOR PRINTING-TELEGRAPH RECEIVERS; George S. Hiltz, New York, N. Y. App. filed July 21, 1915. Applies ink evenly across type-wheel inking roller.

1,313,304. SECONDARY ELECTRIC CLOCK; Frank F. Landis, Waynesboro, Pa. App. filed July 27, 1915. Positive operation of clock system.

1,313,305. SYNCHRONIZING CLOCK SYSTEM; Clinton E. Larrabee, Binghamton, N. Y. App. filed Dec. 12, 1918. New form of master clock.

1,313,319. INTERNAL-COMBUSTION-ENGINE IGNITION INDICATOR; Julius J. Miller, St. Joseph, Mich. App. filed Aug. 27, 1917. Indicates defective spark plugs.

1,313,323. GAS DETECTOR; Milton A. Nobles, Philadelphia, Pa. App. filed Dec. 27, 1916. An electric alarm device to indicate methane or ethane gases in mines.

1,313,324. SEPARATOR FOR STORAGE BATTERIES; Horace W. Nordyke, Indianapolis, Ind. App. filed Sept. 18, 1917. Thin wood body strengthened at points of greatest stress.

1,313,328. ELECTRICAL ATTACHMENT PLUG; Johann G. Peterson, Jersey City, N. J. App. filed Dec. 1, 1917. Compact extension plug.

Record of Electrical Patents

Notes on United States Patents

1,313,329. OUTLET CAP AND METHOD OF MAKING THE SAME; James C. Phelps, Springfield, Mass. App. filed Nov. 1, 1917. Outlet leads spread and secured; caps used on ends of conduits.

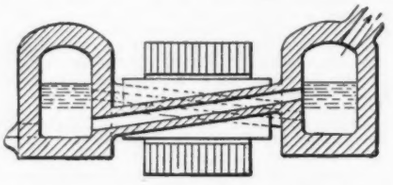
1,313,346. AUTOMOBILE SIGNAL; Hampton K. Smith, Union, S. C. App. filed Feb. 28, 1918. Electric circuit operating automobile signal and headlight.

1,313,384. BATTERY-SUPPORTING DEVICE; Miller R. Hutchison and Charles W. Norton, West Orange, N. J. App. filed Jan. 20, 1917. Arrangement for rigidly supporting and holding battery cells in compartments.

1,313,406. VACUUM-TUBE REPEATER; Robert C. Mathes, New York, N. Y. App. filed Dec. 27, 1918. Maintains potential of grid or control electrode.

1,313,413. COMPOSITE RINGING APPARATUS; Harold S. Osborne, New York, N. Y. App. filed Aug. 1, 1918. Signaling arrangements for transmission lines composited for telephone and telegraph service.

1,313,431. DYNAMO-ELECTRIC MACHINE; Henry H. Wait, Chicago, Ill. App. filed Aug. 22, 1917. Outer and inner mounting.



1,313,274—Means for Reducing Ores

1,313,438. CUT-OUT FOR ELECTRIC LIGHTING SYSTEMS; Dana E. Wescott, South Bend, Ind. App. filed March 31, 1916. Solenoid operation.

1,313,456. JOINT OR COUPLING FOR ELECTRICAL CONDUITS; William A. Bonnell, Brooklyn, N. Y. App. filed April 10, 1916. For joining sections of metal molding.

1,313,477. TRUNK CIRCUITS; Harry N. Faris, Kansas City, Kan. App. filed Nov. 26, 1915. Construction and circuit arrangements for interconnecting subscribers' lines.

1,313,483. HIGH-FREQUENCY-CARRIER TELEPHONY; Raymond A. Heising, East Orange, N. J. App. filed Aug. 14, 1916. Transmission of a plurality of messages over a single circuit.

1,313,512. PROCESS OF COOLING, VENTILATING AND RENDERING INNOCUOUS STORAGE BATTERIES; Charles H. Bedell and Grant E. Edgar, New London, Conn. App. filed Nov. 30, 1915. Adapted for submarines.

1,313,513. STORAGE-BATTERY INSTALLATION; Charles H. Bedell, New London, Conn. App. filed Dec. 22, 1916. Improved construction for submarine use.

1,313,516. PORTABLE FLASHLIGHT; Kenneth A. Cantin, Honolulu, Territory of Hawaii. App. filed March 28, 1918. Resistance in lamp circuit for varying intensity of light.

1,313,519. ELECTRICALLY HEATED FAUCET; Howard K. Clover, Los Angeles, Cal. App. filed June 18, 1918. Combined heater and faucet.

1,313,537. DRIVING ARRANGEMENT OF ELECTRIC MOTORS; George Jones, Manor Park, Eng. App. filed Dec. 21, 1917. Variable-speed mechanism.

1,313,538. ELECTRIC RIVET-HEATING APPLIANCE; George A. E. Jones, New London, Conn. App. filed April 25, 1919. Combined heater and riveting tool.

1,313,539. APPARATUS FOR HEATING RIVETS; George A. E. Jones, New London, Conn. App. filed April 25, 1919. Separate apparatus for heating rivet which is in place.

1,313,555. CABINET-TYPE SAFETY SWITCH PANEL; William F. O'Neill, Wilkinsburg, Pa. App. filed April 20, 1918. Double-doored front.

1,313,561. TIMER; Hiram H. Shelters, Burlington, Vt. App. filed March 28, 1918. Improved removable attachment for timer.

1,313,570. SUBSTATION TELEPHONE CIRCUITS; Bernard D. Willis, Chicago, Ill. App. filed Aug. 23, 1916. Circuit arrangement for automatic telephone system.

1,313,571. FORM FOR OUTLINING ELECTRIC FURNACE CHANNELS; James R. Wyatt, Philadelphia, Pa. App. filed Jan. 10, 1918. Protects lining from injury caused by expansion.

1,313,572. ELECTRIC WELDING TOOL; John K. Baker, Irwin, Pa. App. filed Dec. 9, 1918. Adapted for arc welding.

1,313,574. ELECTRIC STARTING AND IGNITION SYSTEM; John G. P. Thomas, Barnes, London, Eng. App. filed Jan. 4, 1919. Avoids separate starting magneto.

1,313,583. MEANS FOR CONTROLLING THE ELECTRIC LIGHTING OF MOTOR VEHICLES; Walter Curtis, Willesden Green, London, Eng. App. filed March 2, 1917. Improved switch for control of lights.

1,313,641. ELECTRIC SWITCH; Joseph C. Regan, New Britain, Conn. App. filed April 10, 1919. Detachable handle.

1,313,654. RECEIVER OF ELECTRICAL OSCILLATIONS; Roy A. Weagant, Roselle Park, N. J. App. filed April 25, 1914. Adapted to wireless telegraphy.

1,313,656. TROLLEY-WIRE HANGER; Bert A. White, Detroit, Mich. App. filed Oct. 21, 1916. Adapted to a tilting movement of clam.

1,313,666. SEARCHLIGHT ARC LAMP; Heinrich Beck, Schenectady, N. Y. App. filed June 15, 1916. Automatic control.

1,313,671. FUSE PLUG; Frank Capello, Schenectady, N. Y. App. filed Sept. 20, 1917. Solderless.

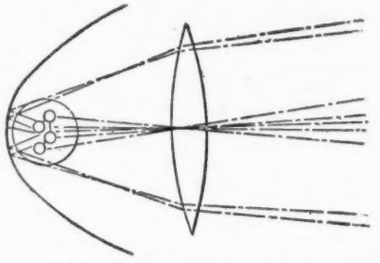
1,313,673. POWER-GENERATING SYSTEM; Frank E. Case, Schenectady, N. Y. App. filed June 18, 1917. Adapted for transmission of power for automobiles.

1,313,690. SENDER FOR WATER-STAGE RECORDERS; Wendell Hess, Jr., Troy, N. Y. App. filed Feb. 18, 1918. Impulses transmitted from float gage to water-stage recorder.

1,313,701. ELECTRIC SWITCH; Charles J. Klein, Milwaukee, Wis. App. filed July 3, 1914. Snap type.

1,313,746. ELECTRIC MELTING FURNACE; James D. Shipton, Vancouver, B. C., Canada. App. filed Feb. 8, 1919. Deflection of heat.

1,313,751. VIBRATION-TRANSFERRING MEANS; Harold Smith, Copenhagen, Denmark. App. filed Aug. 23, 1916. Adapted to telephone diphragms and talking machines.



1,313,857—Incandescent Lamp

1,313,755. STOP MOTION FOR LOOMS; Jules Stuer, Methuen, Mass. App. filed Nov. 23, 1915. Electromechanical stop for looms.

1,313,761. ELECTRICAL FURNACE; Antonio M. Teixeira, Ipanema, Sao Paulo, Brazil. App. filed Nov. 7, 1918. Repairs facilitated.

1,313,766. ALARM FOR TIN-CLEANING MACHINES; Ura U. Ulam, Chester, W. Va. App. filed Nov. 4, 1918. Automatic signal to prevent cobbling of sheets.

1,313,770. AUTOMOBILE SIGNAL; Jerry M. White, Boston, Mass. App. filed March 20, 1918. Adapted to traffic signals for motor vehicles.

1,313,857. INCANDESCENT LAMP; Arthur R. Dennington, East Orange, N. J. App. filed March 16, 1915. Filament mounting simple and rugged.